7. CONGENITAL ANOMALIES OF THE URETER:

Congenital anomalies of the ureter relate to anomalous development of the ureteric bud(s) off the mesonephric ducts.
Male: mesonephric (Wolffian) duct, future vas deferens seminal vesicle, common ejaculatory duct, opens on colliculus seminalis superior to introitus of vagina masculinus).
Female: mesonephric (Gartner's) duct, runs alongside the fallopian tube, in anterolateral wall of the uterus, and upper 1/3rd of the vagina, posterior wall of the glandular and membranous urethra, opening on posterior lip of external urethral orifice, anterior to introitus of the vagina.)

Ureteral diverticulum:
A ureteral diverticulum is a blind ending branch, of variable length, usually arising from the lower ureter.

Duplications:
Partial duplications are caused by branching of the ureteral bud/diverticulum, prior to engaging nephrogenic blastema. Ureter. The ureter is singular upon entering the bladder.
Complete duplication of the ureters is due to separate buds originating from the mesonephric duct at varying distances apart. Completely duplicated ureters have separate openings in the bladder.
Orthotopic complete duplication develops when a pair of ureteric buds arises from the mesonephric duct. The intravesical segments of the ureters share a common sheath and enter the bladder at the end of the interureteric ridge. Following the *Wiegert Meyer Rule*, the ureter which arose higher up on the mesonephric duct, serves the *upper moiety of the kidney,* and opens below the ureter of the lower moiety. The ureter which enters higher in the bladder has a shorter intramural tunnel and is more likely to show vesicoureteral reflux into the lower moiety. The ureter that opens lower on the trigone, drains the upper moiety of the kidney and is often obstructed by a ureterocele. The upper moiety is usually the smaller segment of the kidney, with fewer calices and at higher risk for hydronephrosis due to obstruction.

Ectopic ureter:
Ectopic ureter inserts above or below the normal insertion at the lateral end of the interureteric ridge. Single ectopic ureter occurs most often in males. Most ectopic ureters develop in females, usually as part of a duplicated ureter. Ectopic ureter arises from a bud that develops along the course of the mesonephric/Wolffian duct, either above or below the normal site of development. Insertion of the ectopic ureter is distal to the normal site of insertion, when the ureteric bud arises more cephalad than normal from the mesonephric (Gartner's) duct.

Ectopic ureter in the male:
Ectopic ureter that enters below the normal entry at the interureteric ridge, may open in the trigone, bladder neck, prostatic urethra, or colliculus seminalis. The opening is always above the sphincteric complex (DSC), so the patient is not incontinent.

A single ectopic ureter above the interureteric ridge, may enter the seminal vesicle, vas deferens or ejaculatory duct. Ipsilateral kidney absent/dysplastic, absent hemitrigone. (Atresia

mesonephric duct distal to insertion of ureter). Contralateral, normal kidney, ureter and hemi-trigone.

Ectopic vas deferens, enters ureter:
Rarely, one of the *mesonephric ducts* releases a ureteric bud, and disappears distal to the point of release of the ureteric bud.

A ureteric bud may be released near the midline of a putative hemitrigone. Lengthening of the ureter draws the mesonephric duct/vas deferent cephalad to open in the ureter or a limb of a bifid ureter.

A ureteric bud may be released at the top of the bladder. Cephalad growth of the ureter, draws the mesonephric duct/vas deferens cranially to open in one limb of a bifid ureter.

In these cases, the vas deferens enters a single ureter or a branch of a bifid ureter, that drains a small dysplastic kidney (or absent kidney). The hemitrigone is absent on the affected side. The contralateral solitary kidney and ureter are normal and the presence of a hemitrigone, suggests that the mesonephric duct/vas deferens developed normally on the unaffected side.

Ectopic ureter in the female:
Most ectopic ureters are encountered in females, and most present as part of a duplicated system. if an ectopic ureter the ureter opens in the glandular or membranous urethra, the patient is not incontinent.

If the ureter opens posterior to the distal urethral orifice (behind the membranous urethra), in the vagina or uterus, females present with *paradoxical incontinence*, urine constantly drips through the vestibule, despite a normal voiding pattern.

A female patient with a solitary functioning kidney, may have a contralateral single ectopic ureter that arises from a small hypoplastic or dysplastic kidney, and inserts in the upper end of the vagina, or between the distal urethral orifice and vaginal introitus, that causes paradoxical incontinence.

Of interest, an ectopic ureter that inserts in the fallopian tube, can drain the *upper moiety* of the ipsilateral kidney.

Unilateral renal agenesis:
Bilateral vasa deferentia and ejaculatory ducts present:
a) Solitary kidney and hemitrigone. (Normal mesonephric duct generates ureteral bud)
Contralateral renal agenesis (agenesis of ureteric bud). Vas deferens and ejaculatory ducts
Mesonephric duct present, linear hemitrigone adjacent to hemitrigone.

b) Congenital unilateral absent vas (CUAVD):
Ipsilateral agenesis of mesonephric duct, agenesis of ureteral bud and kidney.
Contralateral normal mesonephric duct, hemitrigone; normal ureteric bud, ureter and kidney.

c) Congenital bilateral absent vas (CBAVD), with or without cystic fibrosis:

CBAVD in males:
Bilateral normal kidneys, normal trigone. (Atresia/agenesis of mesonephric ducts, cephalad to the level of generation of normal ureteral buds).

Solitary kidney with normal hemitrigone. (Atresia mesonephric duct cephalad to level of generation of normal ureteral bud). Contralateral renal agenesis. (Atresia/agenesis meso-nephric duct, agenesis ureteral bud).

Congenital bilateral absence of Gartner's ducts in females:
Duplicated ectopic ureter, opening in the vagina, suggests atresia/agenesis of mesonephric/ Garner's duct below vagina. Contralateral duplicated ectopic ureter with opening at external urethral orifice, suggests Gartner's duct present. (? Expect normal trigone).

Ureteral diverticulum:
A ureteral diverticulum is a blind ending branch, of variable length, usually from the lower ureter. May be due to incomplete development of bifid ureter.

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