“COMMON URETERIC BUD ANOMALIES”
EMBRYOLOGICAL BASIS AND ITS CLINICAL IMPORTANCE
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ABSTRACT
A ureteric bud anomalies occurrence in the world’s population is very common. One in every thousands babies born usually have some form of ureteric bud congenital anomaly. However these congenital anomalies can vary from individual to individual due to science stating that during embryological development, the ureteric bud is responsible for the collecting system, which includes the major and minor calyces of the kidney, the ureter and the bladder. Congenital anomalies can vary to the abnormal development in any of these stated parts.

Keywords
Mesonephric diverticulum, Ureteropelvic junction, Ureterocele, Vesicoureteral reflux.

Introduction
The ureteric bud is a projection formed in the mesonephric duct during the embryological development of the urinary and genital systems.[1-3]The ureteric bud is also known as the mesonephric diverticulum. The ureteric bud forms the ureter. As embryological development continues, the ureteric bud forms a drainage channel for urine on the left and right side of the the urinary system, this channel is known as the ureter.[4-6] The ureter is originated from the mesonephric blastema. There are many variations of anomalies that can occur during embryological development of the ureteric bud. These congenital anomalies may vary in both males and females depending on its origination.[7] However, there are ureteric bud anomalies that are found in both gender but have a higher prevalence in one gender more than the other. Some of the ureteric bud anomalies found in both males and females include: Renal Agenesis, Renal Dysplasia, Megaureter, Ureterocele, Ectopic ureter, Duplicated ureter and obstruction of the UPJ (ureteropelvic junction).[8-10]. The anomalies may be originated on the distal or proximal end of the ureter and can either be unilateral or bilateral, meaning it affects one or both ureters.

Incidence
The epidemiology of the occurrence of ureteric bud anomalies may vary depending upon the particular anomaly. In terms of anomalies relating to the duplication of the ureter, this occurs in less than 1% of the population, but is mostly common in children UTIs, which has an incidence of 8%.[11] The incidence for ureteroceles ranges from 1 in every 5000 to 12000 persons. 10% can be bilateral, while 60 to 80% are ectopic ureters.

Ontogenesis for the normal development of Ureter
To understand the concept of the abnormal development of the ureteric bud, the basic normal development of the ureteric bud is fundamental and must be initially understood. The development of the ureter begins within the fourth week of the gestation period. The ureteric bud divides from the mesonephric duct, also commonly known as the Wolffian duct.[12-13]. The ureteral bud then extends into the mesonephric blastema. The ureteric bud is responsible for the formation of the entire renal collecting system, which begins from the ureteral orifice to the collecting ducts of the kidney. The mesonephric duct is integrated into the developing bladder at the distal portion of the ureteral bud. The ureteral orifices travels superior and laterally and takes its normal position on the trigone. The distal portion of the mesonephric duct travels inferior and medially and is incorporated into the neck of the bladder.[14-16] This occurrence differs in both males and females, in the male fetus, it develops into the seminal vesicle, vas deferens and epididymis and in the female fetus it progress into the Gartner duct, which is situated between the vagina and urethra.[17].

Ontogenesis for the Ureter anomalies
There are various abnormalities that can occur in the ureteric bud. This can be classified due to location and position. In this segment there is an elaboration of the various occurrences of ureteric bud anomalies in both males and females.[18-19]. Renal agenesis is a condition whereby the unilateral and bilateral kidneys in the fetus have failed to develop. Bilateral renal agenesis occurs when both the kidneys fail to develop during the gestation period, while unilateral kidney occurs when there is only completed development of one kidney during the gestation period of pregnancy.[20]. This occurs when the ureteric bud fails to develop in the early stages, specifically the fourth week of fetal development. This can occur due to various reasons, one of the most common reasons being hereditary. Renal Dysplasia or multicystic dysplastic kidney is condition whereby the kidney consists of cysts of various sizes all over the kidney.[21]. According to theory, renal dysplasia occurs due to an abnormal induction of the mesonephric mesenchyme by the ureteral bud. This abnormal occurrence may be due to an abnormality in the formation of the mesonephric duct, the malformation of the ureteric bud or degeneration of the ureteric bud around the fourth or fifth week of the gestational period.[22].
Megaureter is a congenital abnormality whereby the ureter is wider than 3/8 of an inch. This condition can be classified under primary and secondary megaureter. Primary being that this enlargement or dilation can occur in the ureter itself and secondary where it protrudes downward and results in the urinary bladder being blocked[23-25]. This anomaly is more frequent in males and can be either unilateral where it affects one ureter or bilateral whereby it affects both[26]. During the fourth week of embryological development of the ureter, specifically the distal portion of the ureter, the longitudinal muscles are absent, the circular muscles are enlarged and there is a significant increase in the connective tissue deposition, all of which results in the congenital anomaly, megaureter.

Ureterocele is a congenital anomaly whereby the bladder end of the ureter is sacculated, the can usually occur either inside or outside of the bladder. This congenital anomaly is more prevalent in females than it is in males[27]. This condition can either be bilateral or unilateral and usually associated with other conditions such as vesicoureteral reflux or due to obstruction of the bladder outlet. Vesicoureteral reflux refers to the backward flow of urine from the bladder into the kidney. The embryological basis behind the formation of Ureterocele is still unknown but however theories do exist[28-29]. During the fourth week of embryological development of the bladder and trigone, there is some form of obstruction to the ureteral orifice with the incomplete termination of the chwalla’s membrane. This membrane separates the ureteric bud from the urogenital sinus, which is being formed. During development of the ureteral orifice the chwalla’s membrane have incompletely perforated, resulting in Ureterocele.

Ectopic ureter is a congenital anomaly whereby the ureter terminates at a different site other than the urinary bladder. This anomaly may occur with the combination or Ureterocele[30-32]. In males, they may suffer from epididymitis due to the direct drainage of urine from the ureter directly in to the vas deferens or seminal vesicle. In females, there is uncontrollable leakage of urine due to the ectopic ureter, which opens below the sphincter in the urethra, which closes so that urine cannot pass[33].

Duplicated ureter is a congenital anomaly whereby during embryological development, the ureteric bud splits or bifurcates which forms two ureters that drains into one kidney. As known, the embryological development of the ureter begins around the fourth week. There is a ureteric bud which arises from the mesonephric duct, this later forms the ureter and other parts of the collecting system[34]. In the case of duplicated ureter, the ureteric bud from the mesonephric duct bifurcates which forms two ureters instead of one. This anomaly can either occur on the right or left side or even on both side, this is called bilateral ureter duplication. Duplication of ureter is more prevalent in females than males[35-36].

Urethral Atresia is a congenital anomaly whereby there is an absence of the ureter or the ureter may fail to reach or extend to the bladder. This can either be unilateral or bilateral.

Obstruction of the ureteropelvic junction is a condition whereby there is a complete or partial blockage at the junction of the kidney and ureter. During the fourth week of embryological development, the muscles surrounding the ureteropelvic junction have developed abnormally which can lead to partial or total blockage (obstruction)[37-39].
In the case of ectopic ureter, a surgical procedure is carried out to correct the placement of the ureter to the urinary bladder. In ureteral duplication there is a surgical procedure to correct the placement of ureter as well there is possible removal of one of the bifurcated ureter[48].

**Conclusion**

In conclusion of this study, due to researches found, ureteric bud anomalies can vary depending on the area of the collecting system in which it affects. Ureteric bud anomalies have one thing in common whereby they can either be unilateral or bilateral however the functional aspect in which it affects may differ. Ureteric bud anomalies frequently occurs and is not very uncommon, however there can be different variation of the occurrence.

**References**


