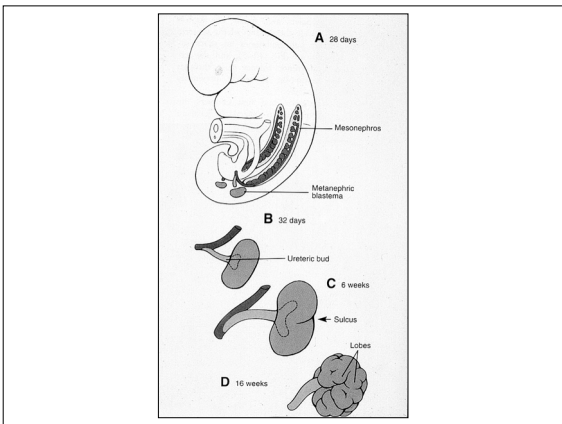
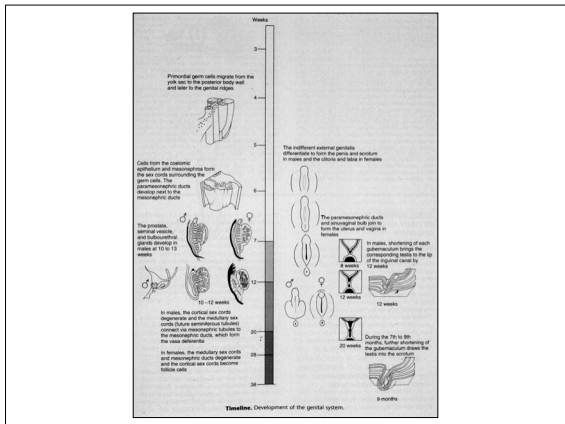
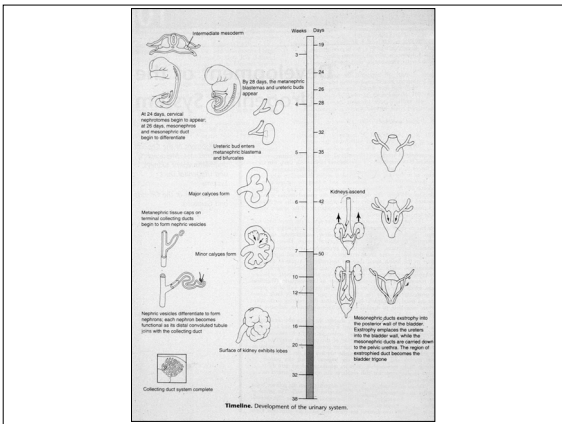




## Normal Development

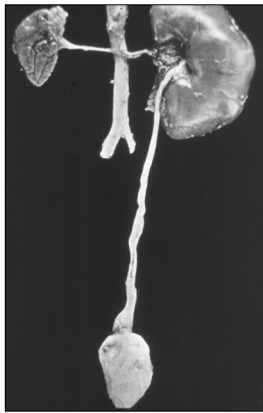


- ## RENAL DEVELOPMENT
- WT-1 Gene located at 11p13 the “master switch” for gonadal development and renal morphogenesis
  - GDNF Glial derived neurotropic factor implicated prominently in renal morphogenesis
  - RET receptor tyrosine kinase is the receptor for GDNF and WT-1 at ureteral bud

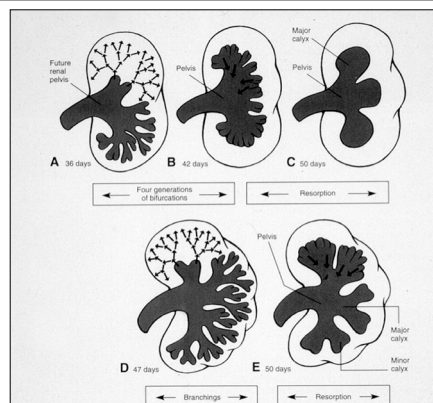
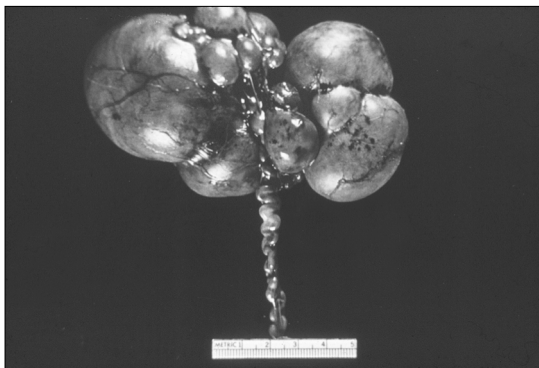
## RENAL DEVELOPMENT

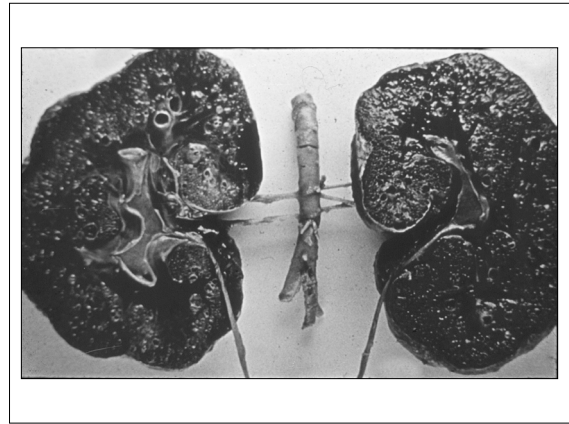
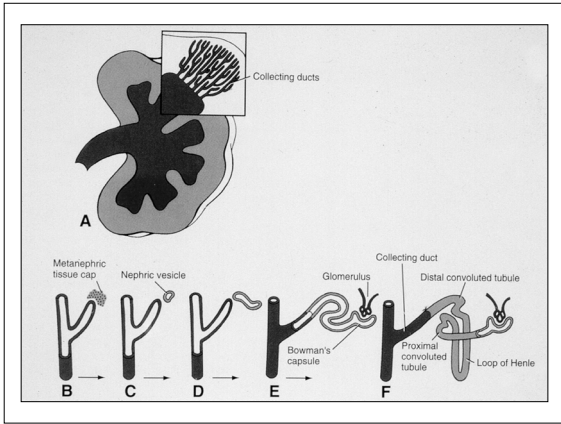
- BOTH WT-1 AND GDNF ARE NEEDED IN THE METANEPHRIC BLASTEMA FOR INDUCTION OF THE URETERAL BUD
- RET ENABLES GDNF AND WT ACTION AT THE URETERAL BUD

## **Renal Agenesis (? WT-1 FAILURE)**



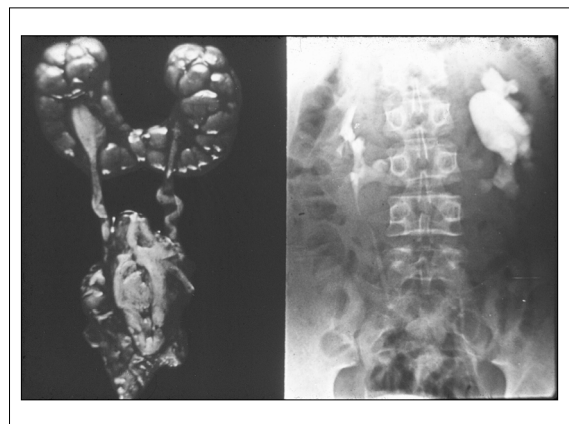
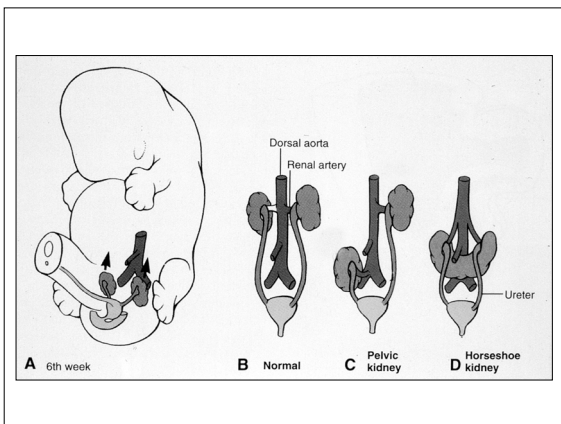
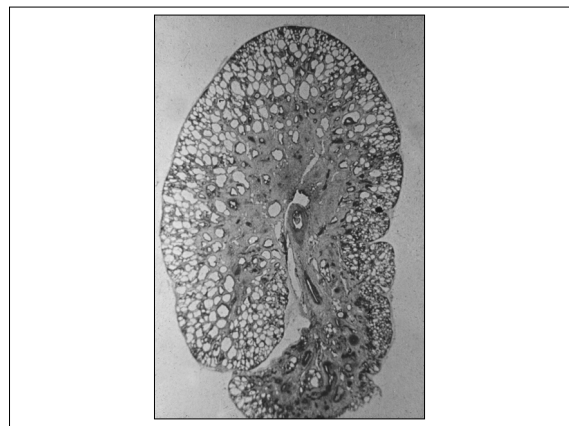
## **Multicystic Kidney (? RET FAILURE)**

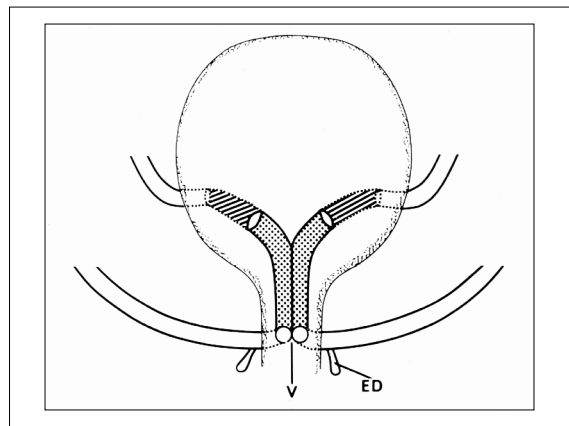
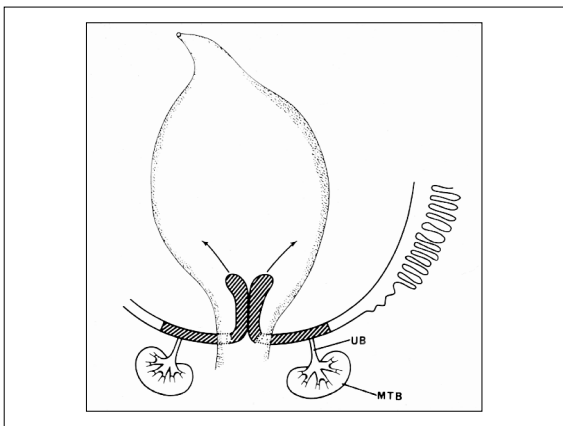
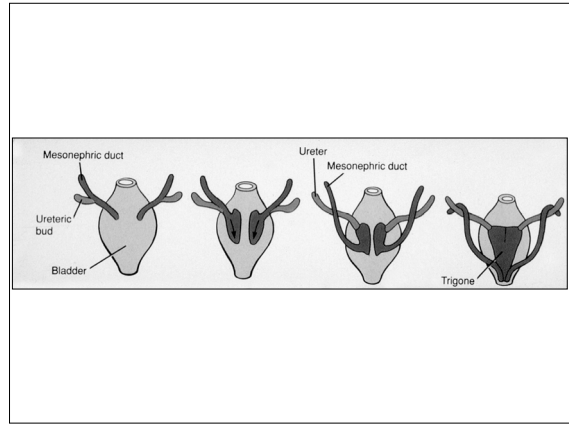
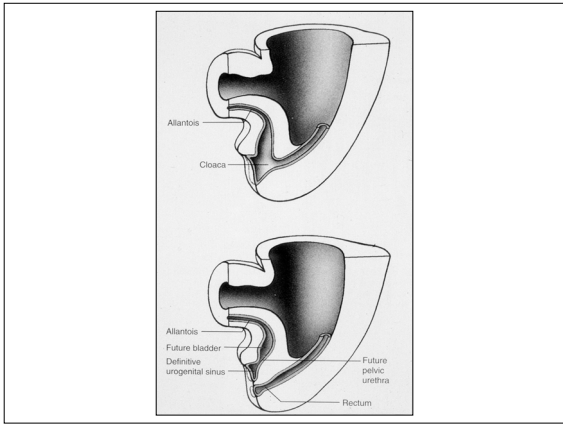




### RENAL MALDEVELOPMENT

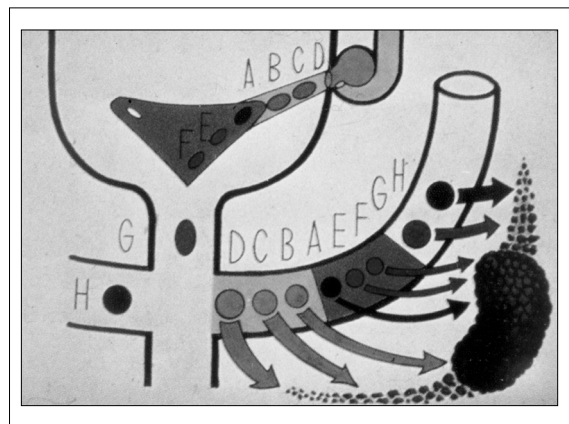
- AN EXAMPLE OF ARPKD-AUTOSOMAL RECESSIVE POLYCYSTIC KIDNEY DISEASE.
- ASSOCIATED WITH NEARLY UNIFORM INFANT MORTALITY
- ASSOCIATED WITH PKHD1 ON CHROMOSOME 6



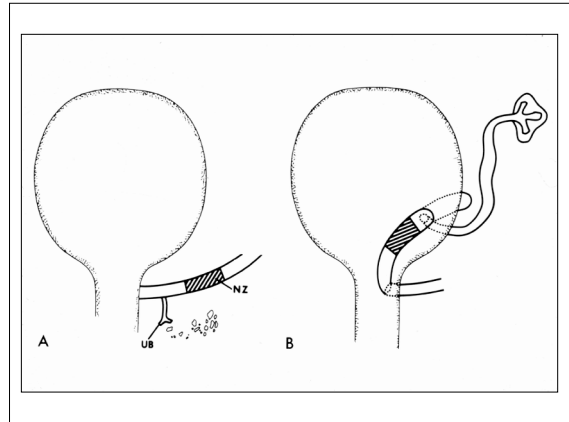


### Abnormalities of Ureteral Bud Development

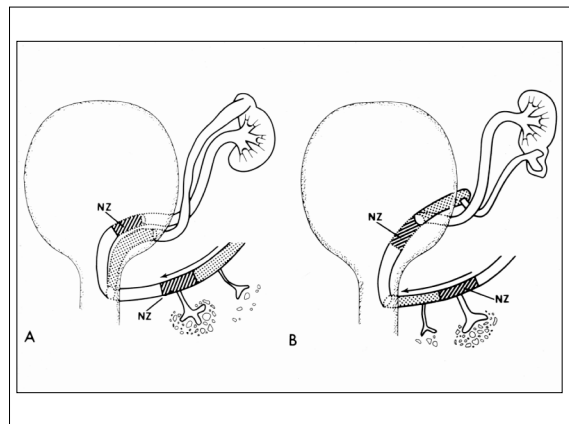
URETERIC BUD DEFECT	ASSOCIATED RENAL ANOMALY
Failure of bud	Renal agenesis
Abnormal position of bud	Ureticosis, ectopic ureter, duplication
Splitting of bud	Duplication anomaly
Excess absorption of bud	Reflexing ureters



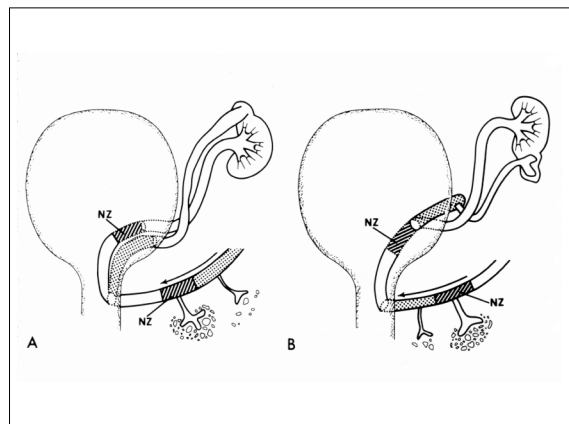
***Vesicoureteral Reflux***

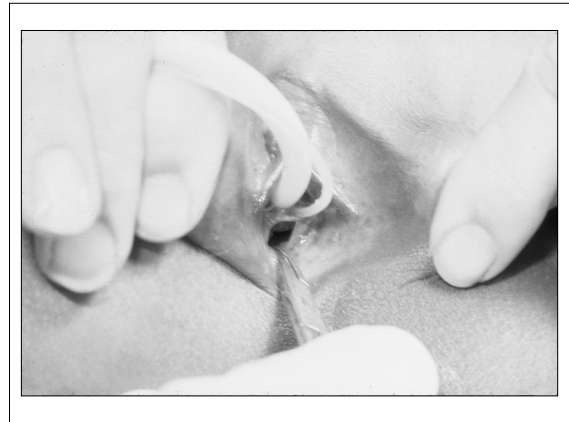
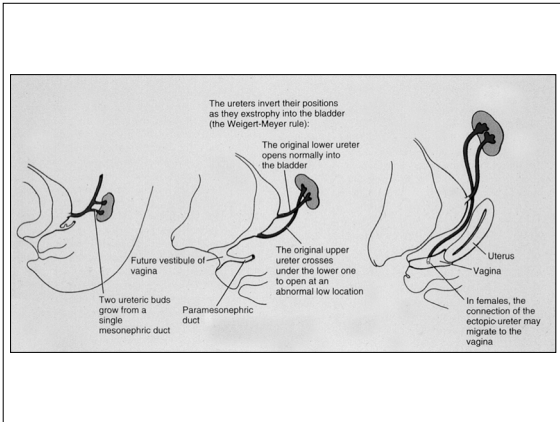


***Ureteral Duplication***

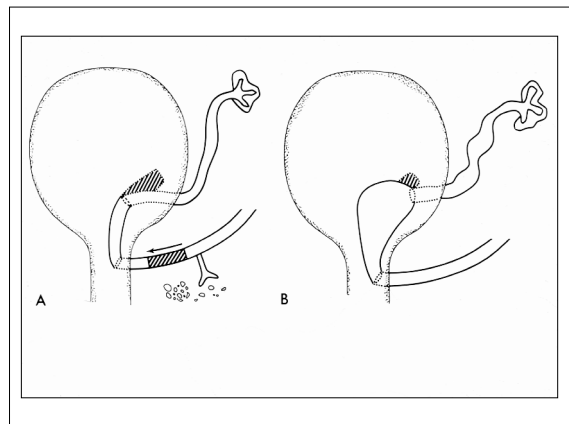


***Ectopic Ureter***



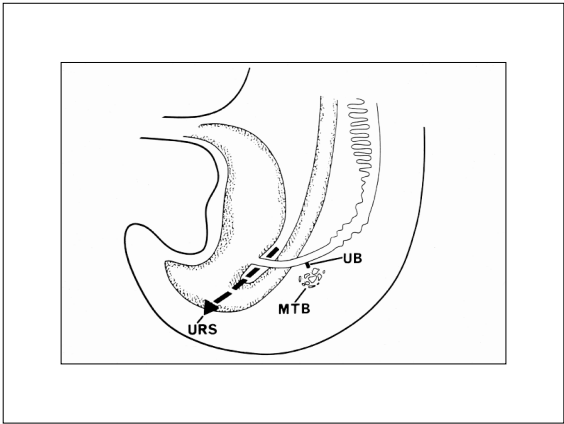


**Ureterocele**

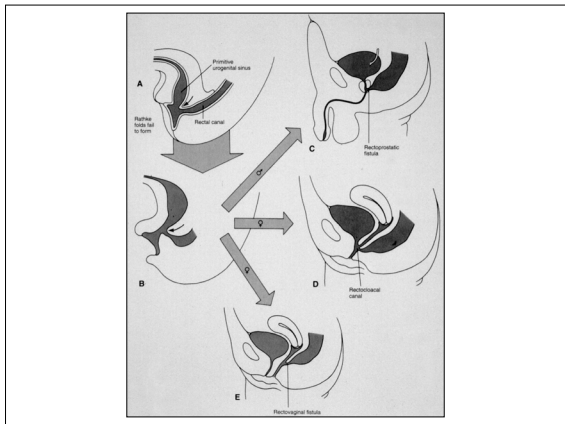


**Diverticulum (Paraureteral)**

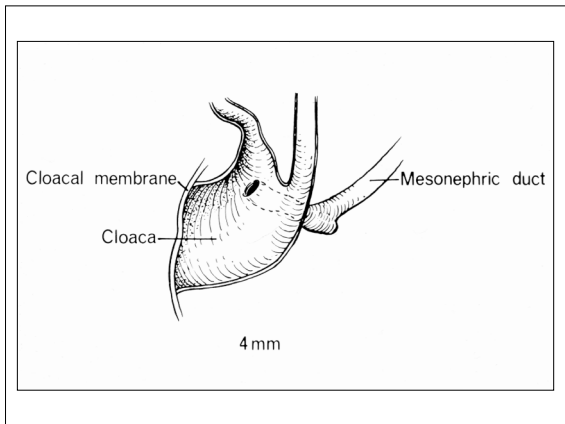
**Cloacal Anomaly**



**Imperforate Anus**

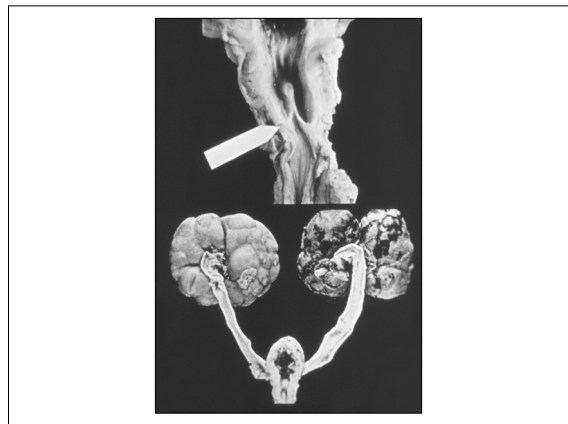
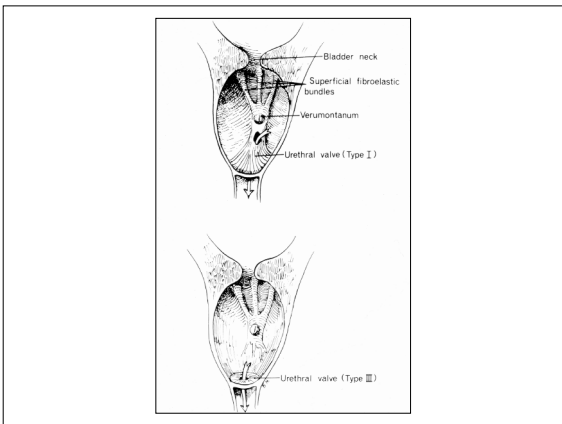
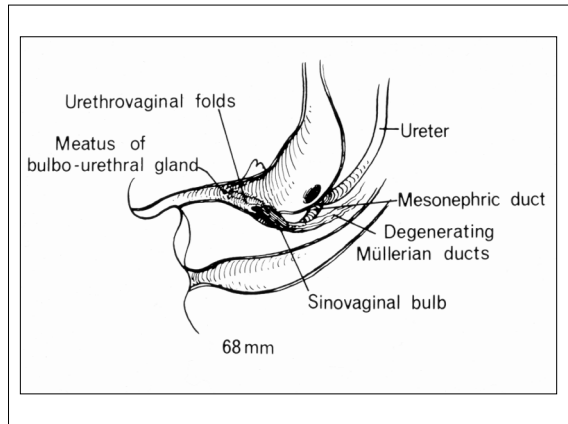


**Exstrophy - Epispadias Complex**



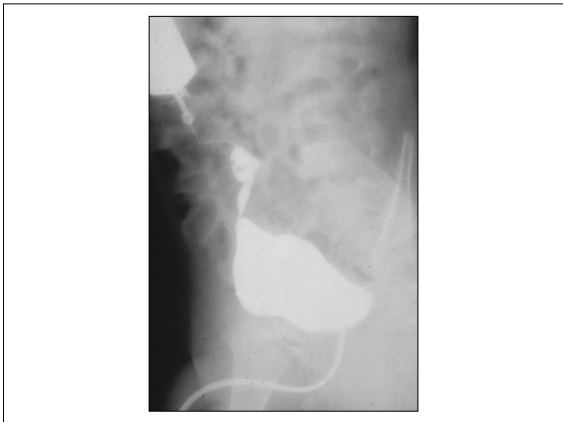
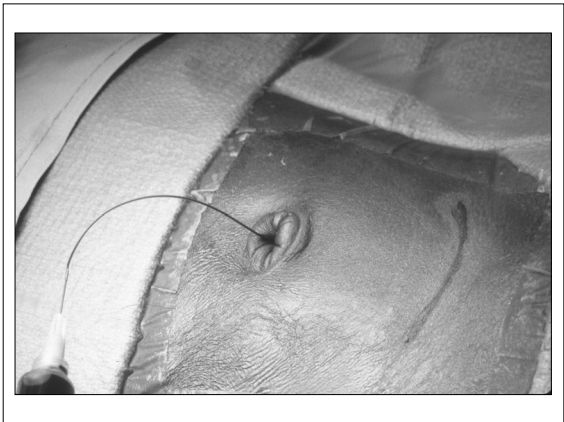
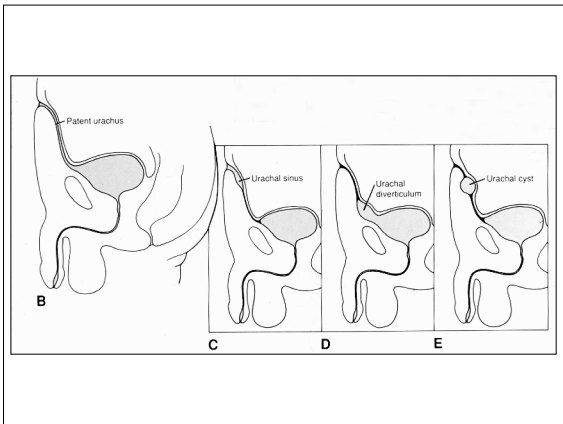
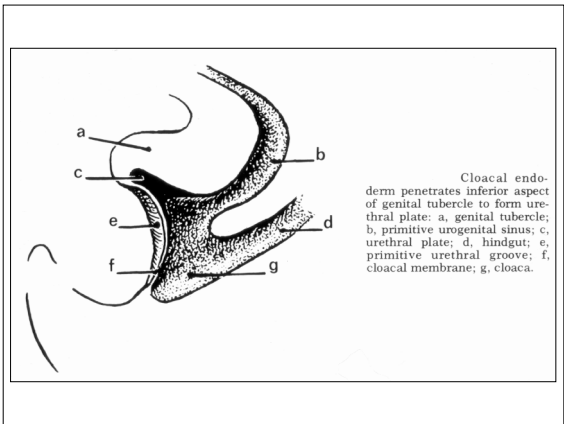


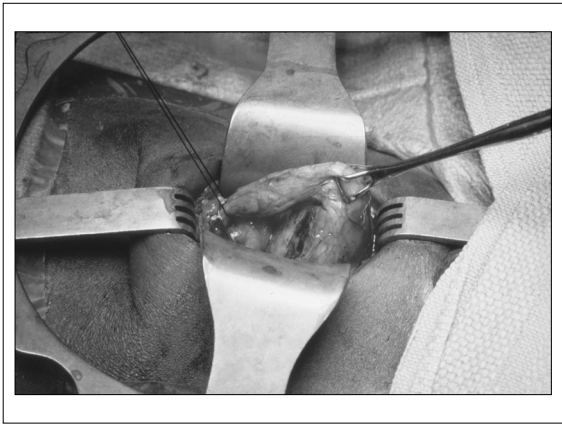
**Posterior Urethral Valves**



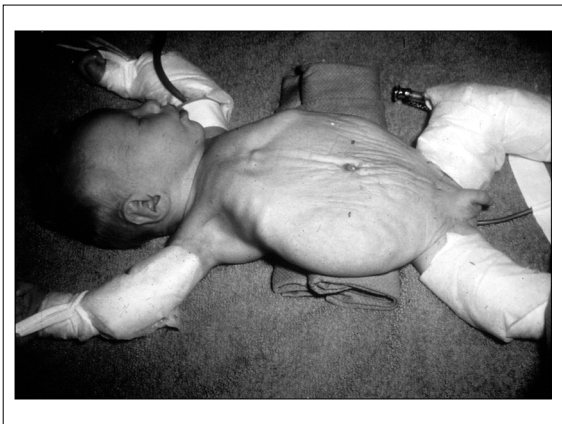


## **Urachal Abnormalities**

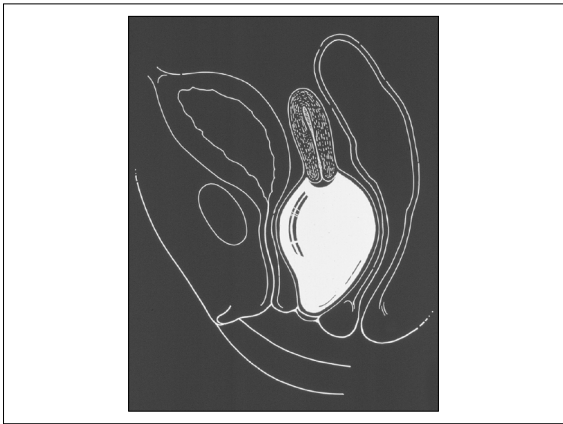
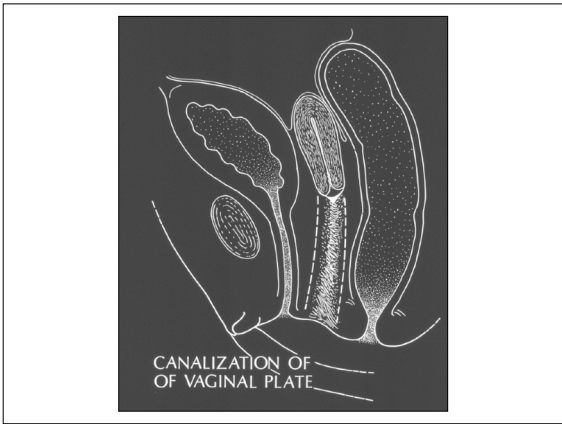




***Prune Belly Syndrome***

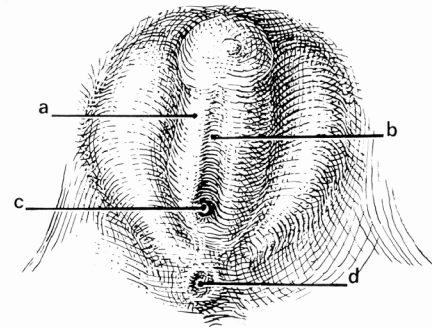


***Anomalies of Vaginal Plate Canalization***

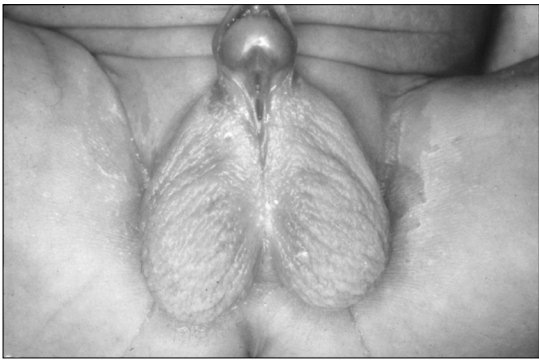


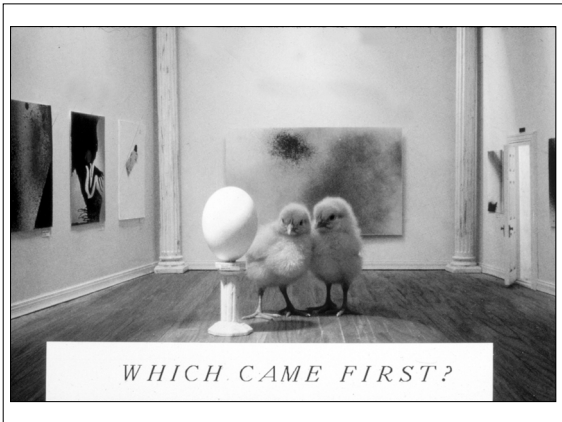
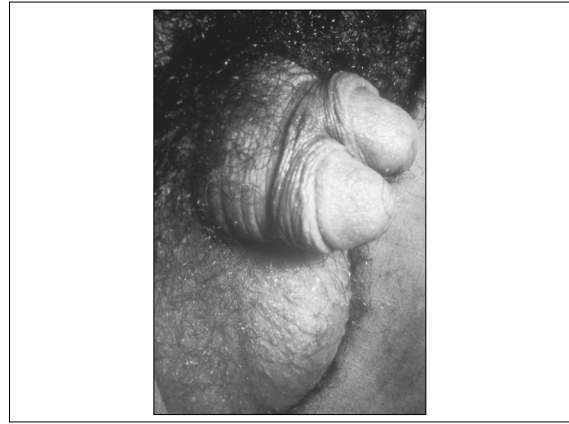
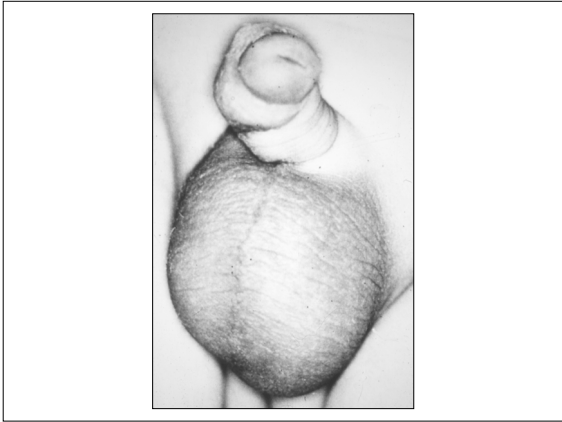


# Hypospadias



External genitalia after cloacal division: a, urethral fold; b, primitive urethral groove; c, urogenital sinus opening; d, anal membrane.





### Urinary System Abnormalities

<b>ANOMALY</b>	<b>GESTATION</b>	<b>ETIOLOGY</b>
Bladder Duplication	8 weeks	Notochord Duplication
Agenesis of Vas and Seminal Vesicles	8-12 weeks	Mesonephric duct abnormality
Agenesis of penis	12 weeks	Genital tubercle defect
Obstructive megaureter	12 weeks	Mesonephric duct abnormality
Ureter Duplication	15 weeks	Ureteral bud defect

## Urinary System Abnormalities

ANOMALY	GESTATION	ETIOLOGY
Exstrophy Epispadias	5-6 weeks	Coel membrane anomaly
Ectopic Ureter	5-6 weeks	Ureter duct defect
Imperforate Anus	8 weeks	Failure of urorectal septum
Ureterocele	7-8 weeks	Resistance of Cloaca's membrane
Residual urethral valves	8 weeks	Resistance of Muller's tubercle

## Urinary System Abnormalities

ANOMALY	GESTATION	ETIOLOGY
Hypospadias	8 weeks	Failure of urethral groove
Urethral Abnormalities	8 weeks	Resistant aortitis
Prune Belly Syndrome	12 weeks	Secondary failure of mesoderm
Undescended Testis	7 months	Failure of androgen response