PIPADOR REVISION

MRCOG Part 1 Revision Notes

Development of the Ureters

EMBRYOLOGY • LECTURE 57

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG Part 1 Revision Notes

Lecture 57: Development of the Ureters

Embryology • Visual revision edition

COLOUR CODE USED THROUGHOUT THESE NOTES

URETERIC BUD	WOLFFIAN DUCT	SURGICAL RISK	ANOMALIES	CLINICAL

LEARNING OBJECTIVES — tick off as you go

- ☐ Trace the ureter and collecting system from the ureteric bud.
- ☐ Explain how the ureter separates from the Wolffian duct and reaches the trigone.
- ☐ Describe the adult ureter's narrowings and its course in the female pelvis.
- ☐ Recognise duplex, ectopic ureter, ureterocele, PUJ obstruction, VUR, megaureter, retrocaval ureter.
- ☐ Know where the ureter is injured at hysterectomy.

1 The Ureteric Bud

IN ONE LINE: *Week 5: a bud off the Wolffian duct grows into the metanephric blastema and branches to become everything that drains urine.*

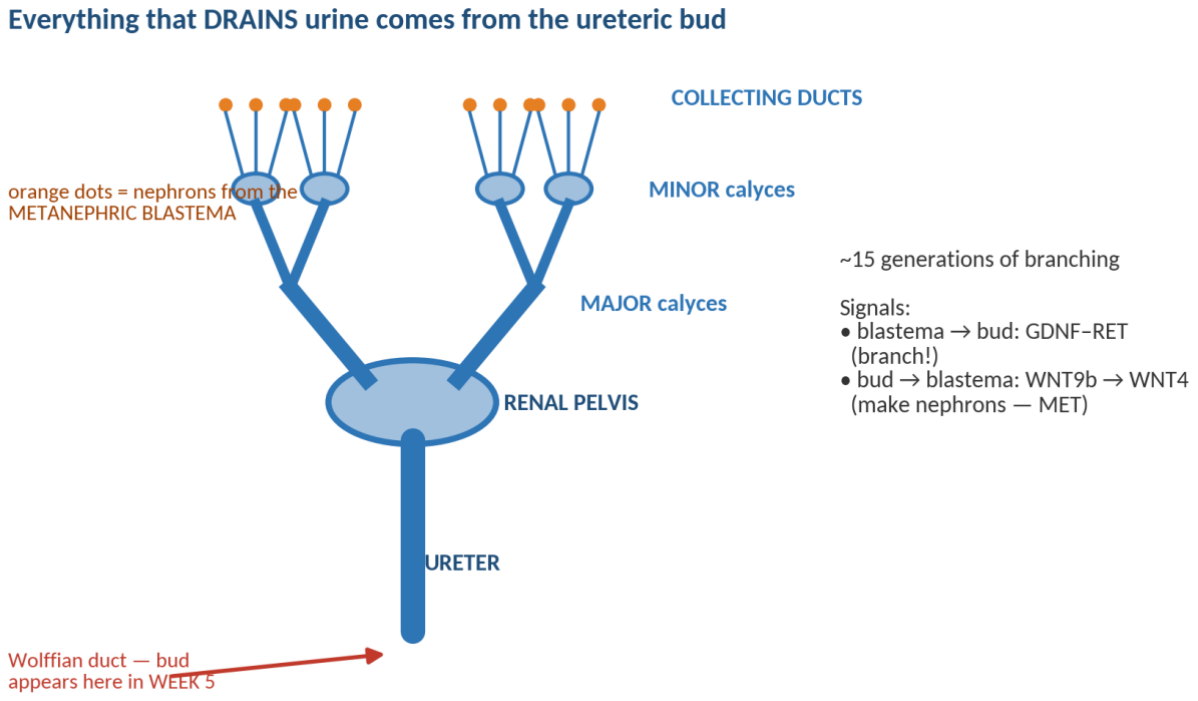
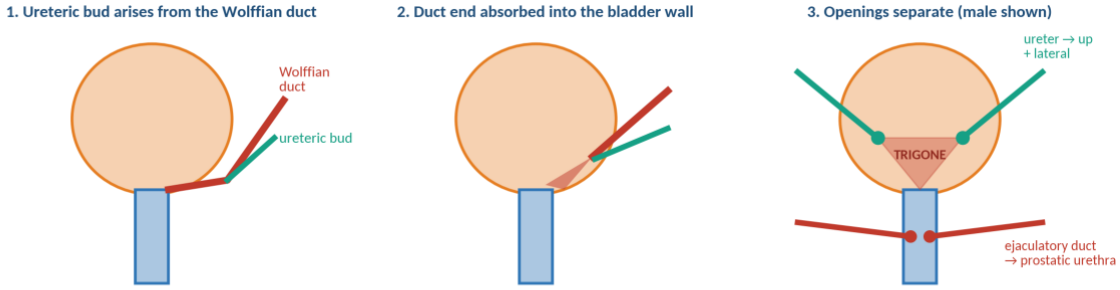


Figure 1. The ureteric bud's derivatives.

2 Separation from the Wolffian Duct



Classic teaching: trigone = incorporated Wolffian (mesodermal) duct, later covered by urothelium. Some newer work suggests it is mostly bladder muscle. In females the duct regresses.

Figure 2. The shared duct end is absorbed and the openings separate (from Lecture 56).

- The **common excretory duct** is absorbed into the back wall of the bladder. **Ureteric orifices move up and out** (trigone); **Wolffian orifices move down** → ejaculatory ducts at the verumontanum in males, regress in females.
- **If separation goes wrong**, the ureter opens in the wrong place → **ectopic ureter** (section 4).

3 The Adult Ureter and Pelvic Surgery

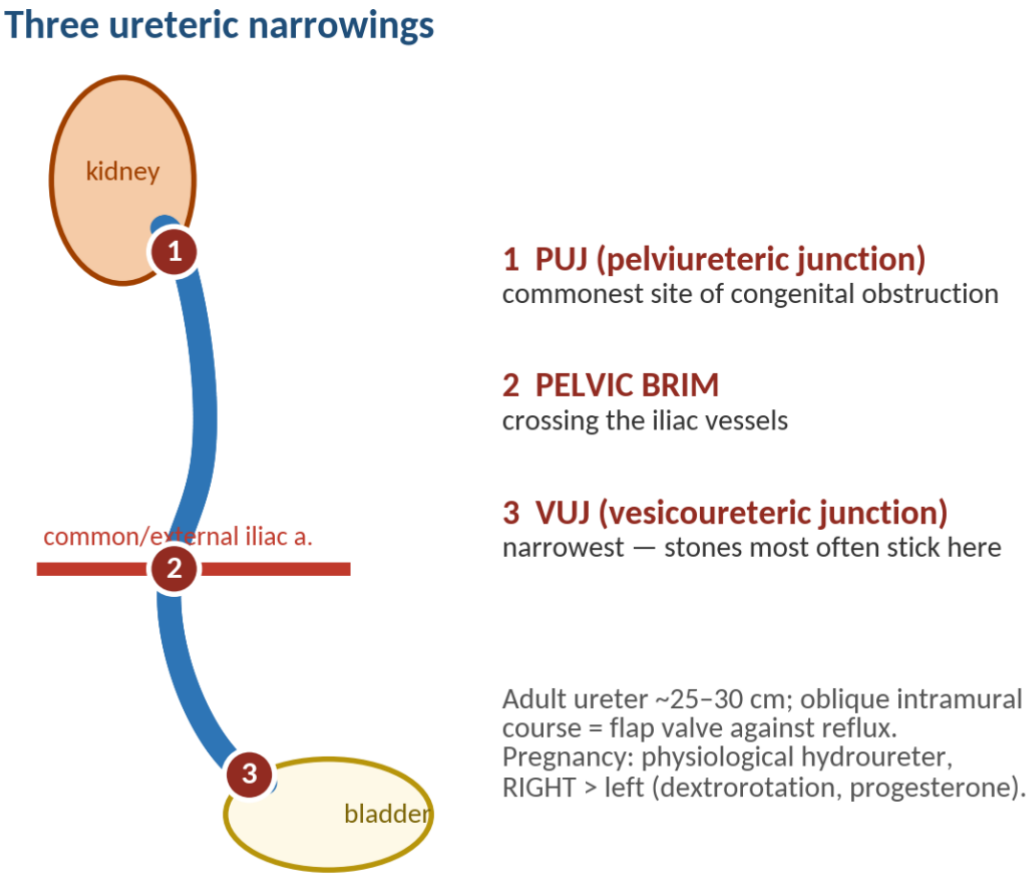


Figure 3. Three narrowings.

- Adult ~25–30 cm; peristalsis starts from **pacemaker cells in the renal pelvis** (1–5 waves/min). The **oblique intramural tunnel** acts as a flap valve against reflux.

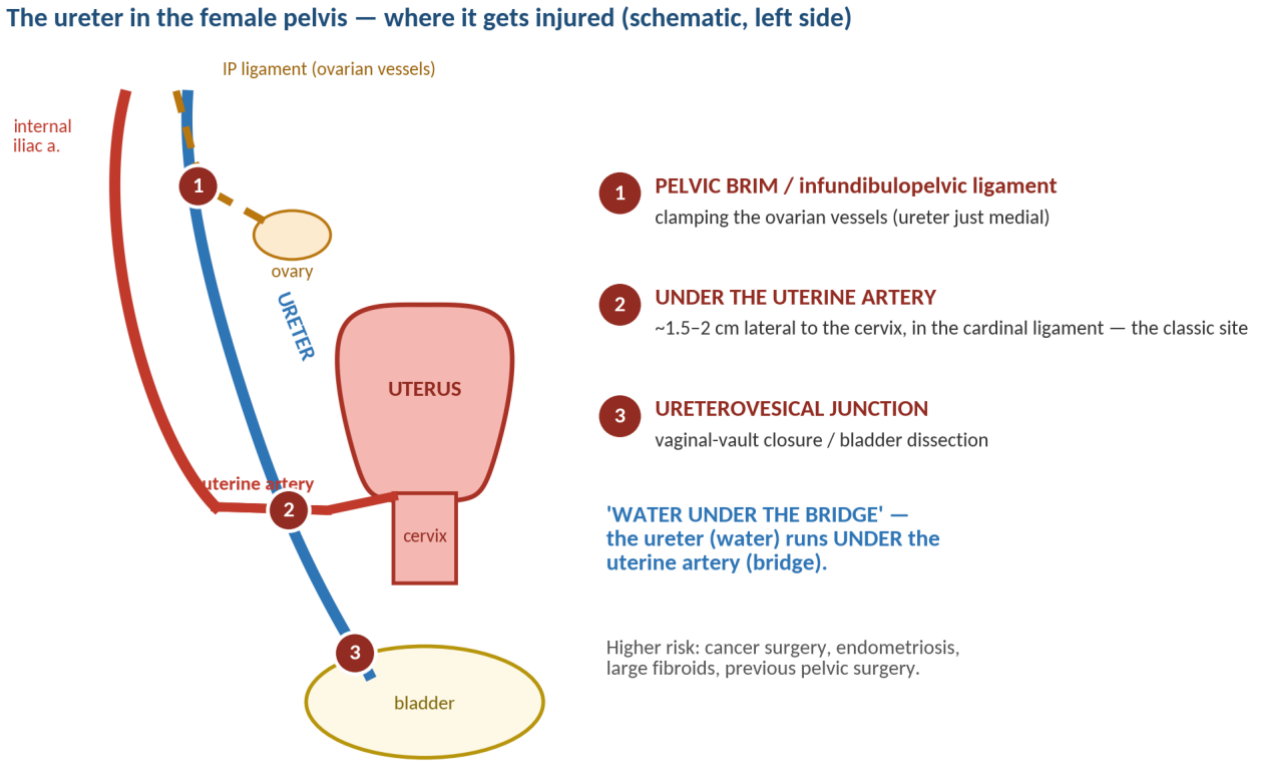


Figure 4. The ureter in the female pelvis.

EXAM HOOK

'Water under the bridge': the ureter passes **under the uterine artery**, ~1.5–2 cm lateral to the cervix, in the cardinal ligament — the classic site of injury at hysterectomy. The other two are the **pelvic brim / IP ligament** and the **ureterovesical junction**.

4 Congenital Anomalies

Anomaly	Key points
Duplex / bifid	Early split of the bud → bifid (partial) or complete duplex — Weigert–Meyer: upper pole inserts inferomedially (obstructs, ectopic, ureterocele); lower pole superolaterally (refluxes)
Ectopic ureter	Faulty separation from the Wolffian duct. Girls: may open below the sphincter (urethra, vestibule, vagina) → constant dribbling in a child who otherwise voids normally. Boys: always above the external sphincter → continent (UTI, epididymitis)
Ureterocele	Cystic swelling of the intravesical ureter — often the upper-pole ureter of a duplex; 'cobra head' on IVU; can block the bladder neck
PUJ obstruction	Intrinsic muscle defect or crossing lower-pole vessel; commonest pathological cause of antenatal hydronephrosis (most mild dilatation is transient); pyeloplasty if severe
Vesicoureteric reflux	Short intramural tunnel; grades I–V; UTIs, scarring; selective prophylaxis, endoscopic injection (dextranomer–hyaluronic acid) or reimplantation
Megaureter	Ureter > 7 mm — refluxing, obstructed, both, or neither

Anomaly	Key points
Retrocaval ureter	Right ureter hooks behind the IVC — a venous anomaly: the infrarenal IVC forms from the right posterior cardinal vein instead of the supracardinal; 'fish-hook' course → obstruction

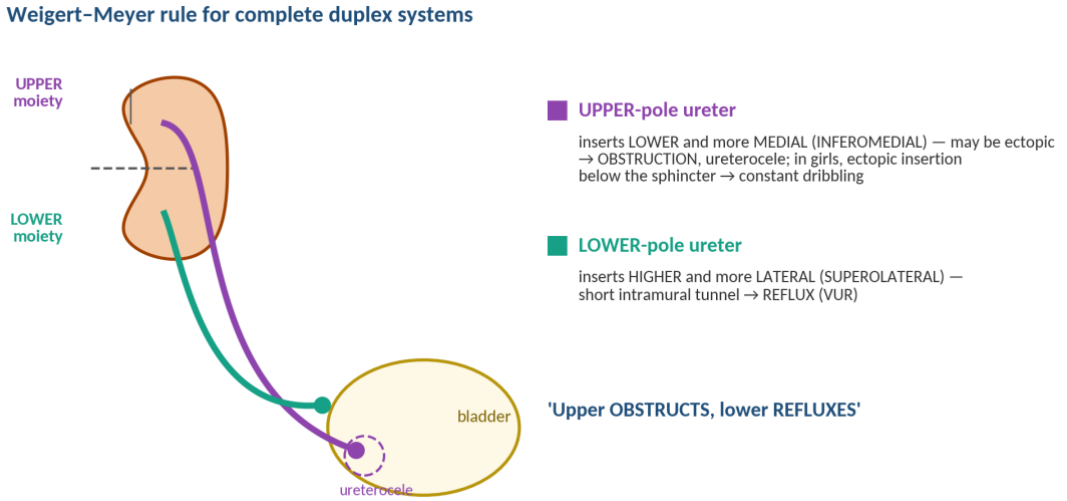


Figure 5. Weigert–Meyer rule (from Lecture 55).

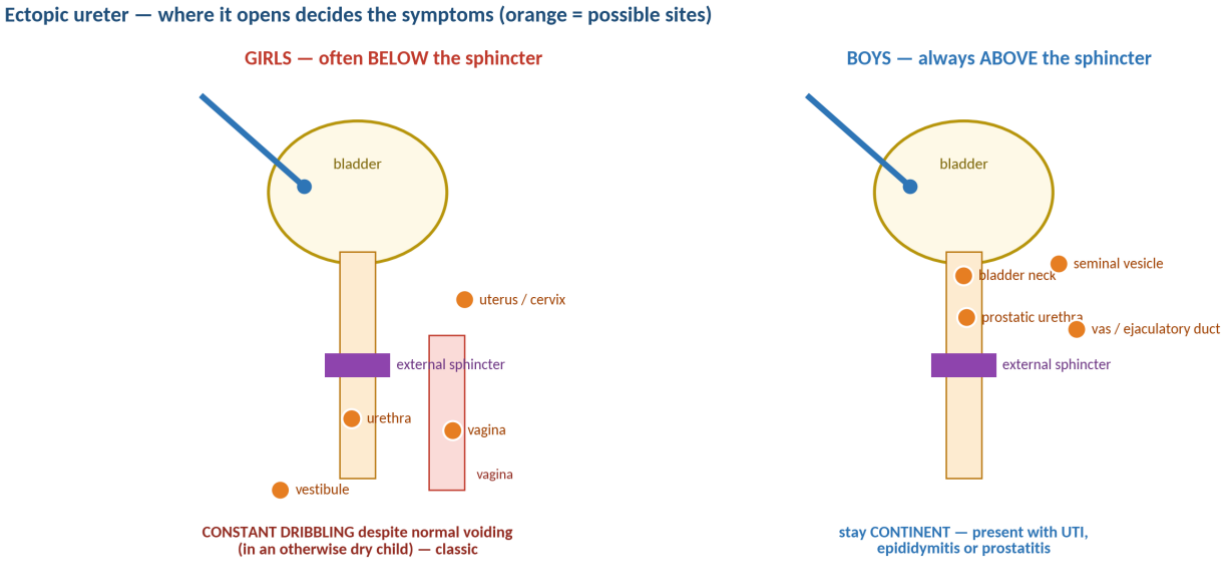


Figure 6. Ectopic ureter in girls vs boys.

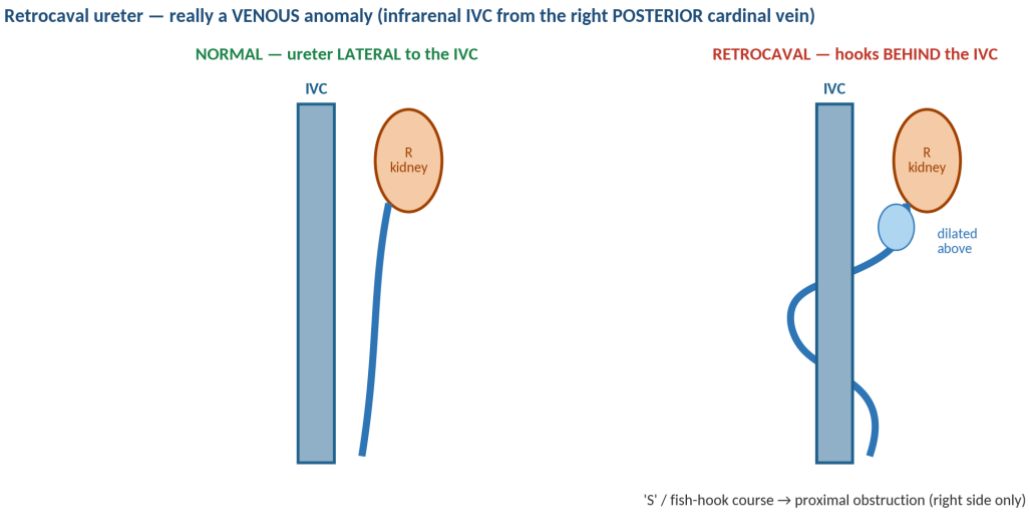


Figure 7. Retrocaval ureter.

5 Clinical Points

ANTENATAL

- The 20-week anomaly scan picks up hydronephrosis, dilated ureters, duplex kidneys, ureteroceles
- **Renal pelvis AP diameter**: UTD consensus — **≥ 7 mm from 28 weeks** needs postnatal follow-up (UK units often use ≥ 10 mm in the 3rd trimester)

PREGNANCY + STONES

- **Physiological hydroureter**, RIGHT > left (dextrorotation, progesterone, ovarian vein)
- Stones stick at the **PUJ, pelvic brim, VUJ**
- Ureteric injury at hysterectomy is more likely with cancer, endometriosis, fibroids or previous surgery

★ PEARL

Girl who is always damp but voids normally = ectopic ureter (upper pole of a duplex, opening below the sphincter).

Retrocaval ureter is a vein problem, not a ureter problem.

6 MRCOG Exam Pearls — Last-Minute Page

Numbers to know

Week 5 Ureteric bud appears	**~15** Branching generations	**25–30 cm** Adult ureter	**3** Narrowings
1.5–2 cm Uterine a. crossing from cervix	**> 7 mm** Megaureter	**≥ 7 mm** APD from 28 wk (UTD)	**I–V** VUR grades

HIGH-YIELD CHECKLIST

- ☐ Ureteric bud from the Wolffian duct, week 5.
- ☐ Bud → ureter, pelvis, major + minor calyces, collecting ducts.
- ☐ GDNF–RET (branch) and WNT9b → WNT4 (nephrons).
- ☐ Common excretory duct absorbed; ureters up + out, Wolffian ducts down.
- ☐ Narrowings: PUJ, pelvic brim, VUJ.
- ☐ Water under the bridge; three injury sites at hysterectomy.
- ☐ Weigert–Meyer: upper obstructs, lower refluxes.
- ☐ Ectopic ureter: dribbling girls, continent boys.
- ☐ PUJ obstruction = commonest pathological antenatal hydronephrosis.
- ☐ Retrocaval ureter = IVC from the posterior cardinal vein.

Self-assessment — cover the right-hand column

Question	Answer
Where does the ureteric bud come from?	The Wolffian (mesonephric) duct, week 5
Four derivatives of the bud?	Ureter, renal pelvis, calyces, collecting ducts
Weigert–Meyer: which ureter obstructs?	Upper-pole ureter (inferomedial insertion)
Why are girls with ectopic ureter incontinent but boys not?	In girls it can open below the external sphincter; in boys always above
Three ureteric narrowings?	PUJ, pelvic brim, VUJ
Classic site of ureteric injury at hysterectomy?	Under the uterine artery, ~1.5–2 cm lateral to the cervix
What is a ureterocele?	Cystic dilatation of the intravesical ureter
Cause of retrocaval ureter?	IVC formed from the right posterior cardinal vein
Which side has more hydroureter in pregnancy?	Right
Modern endoscopic treatment for VUR?	Dextranomer–hyaluronic acid injection

7 References

- Sadler TW. Langman's Medical Embryology. 14th ed. 2019.
- Nguyen HT et al. Multidisciplinary consensus on urinary tract dilation (UTD) classification. J Pediatr Urol 2014.
- RCOG Consent Advice No. 4. Abdominal Hysterectomy for Benign Conditions (ureteric injury risk).