



PIPADOR REVISION

MRCOG Part 1 Revision Notes

The Ureters

ANATOMY • LECTURE 14

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG Part 1 Revision Notes

Lecture 14: The Ureters

Anatomy • Visual revision edition

COLOUR CODE USED THROUGHOUT THESE NOTES

URETER	DANGER / INJURY SITE	GONADAL VESSELS	ILIAC ARTERIES	UTERINE ARTERY
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LEARNING OBJECTIVES — tick off as you go

- ☐ Describe the course of the ureter from kidney to bladder.
- ☐ Identify the three physiological constrictions.
- ☐ Describe key relations in the female pelvis (uterine artery, fornix).
- ☐ Recognise histology and innervation.
- ☐ Identify sites of ureteric injury at gynaecological surgery.
- ☐ Apply to imaging and clinical management.

1 Overview, Course and Constrictions

IN ONE LINE: Paired muscular tubes, 25–30 cm long and 3–4 mm wide, retroperitoneal all the way from renal pelvis to bladder.

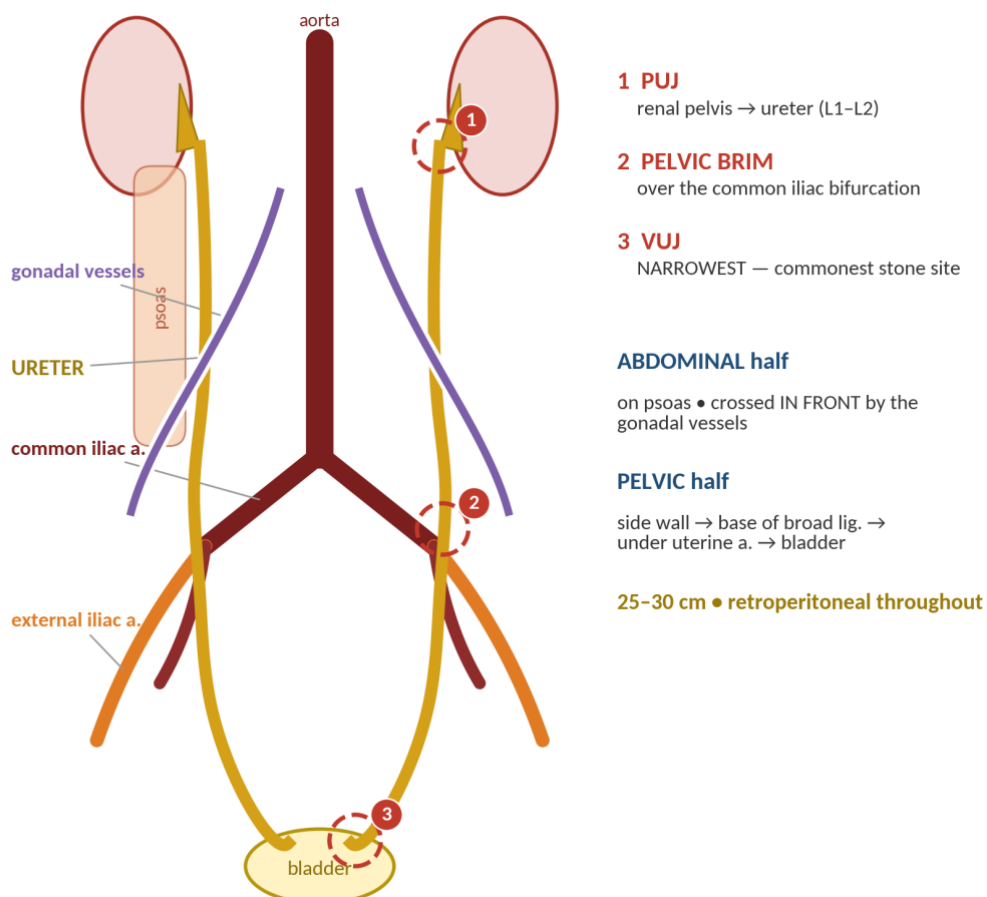


Figure 1. The whole course, with the three natural narrowings circled.

Part	Course and relations
Abdominal (upper half)	Starts at the PUJ (L1–L2) → down on psoas, in front of the L2–L5 transverse processes • crossed IN FRONT by the gonadal vessels • Right: behind the descending (2nd) duodenum, root of mesentery, right colic + ileocolic vessels • Left: behind the sigmoid mesocolon, left colic vessels
Pelvic brim	Crosses into the pelvis over (just lateral to) the common iliac bifurcation
Pelvic (lower half, ~12–15 cm)	Down the lateral wall in front of the internal iliac a., behind the ovary (posterior border of the ovarian fossa) • forward into the base of the broad ligament • under the uterine artery, 1.5–2 cm lateral to the cervix • close to the lateral fornix • into the bladder
Intramural (~1.5 cm)	Oblique through the bladder wall → flap valve against reflux → orifice in the trigone

MNEMONIC / MEMORY HOOK

Three narrowings: 'P-B-V' — Pelvi-ureteric junction, Brim, Vesico-ureteric junction. The last is the narrowest and the commonest stone site.

2 Relations in the Female Pelvis

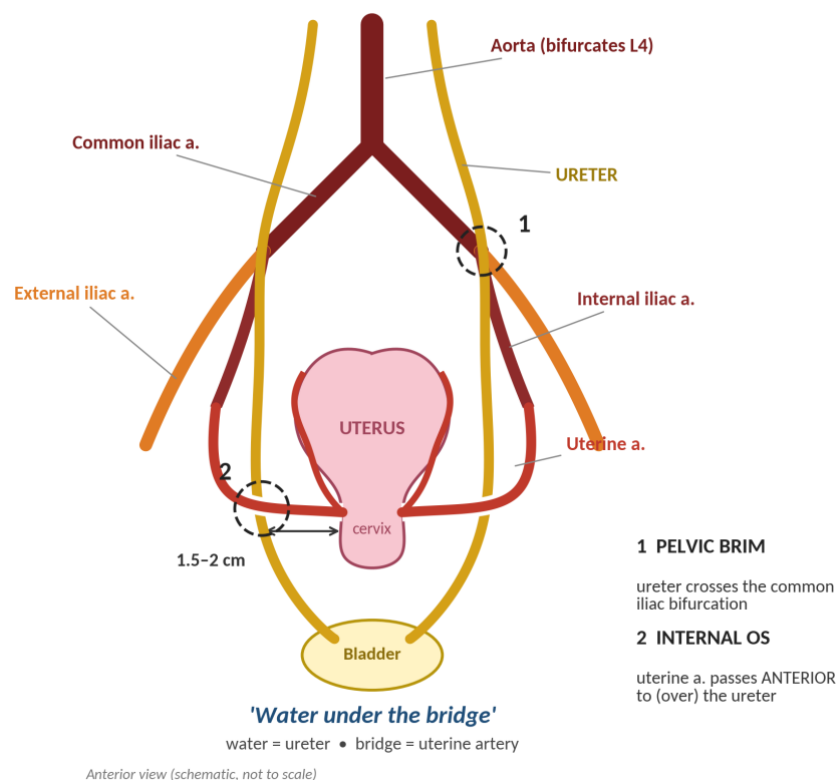
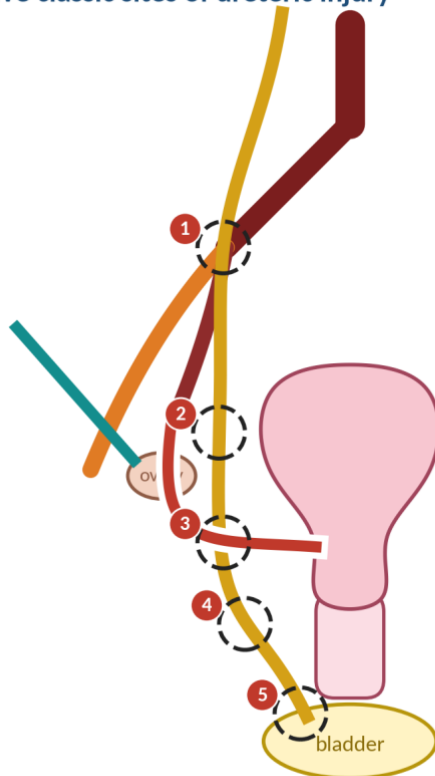


Figure 2. 'Water under the bridge' (from Lecture 3).

Level	Relation
Pelvic brim	Over the common iliac bifurcation; just medial to the ovarian vessels in the IP ligament; posterior border of the ovarian fossa
Broad ligament	Posterolateral → anteromedial through the cardinal ligament; 1.5–2 cm lateral to the cervix at the internal os; passes UNDER the uterine artery

Level	Relation
Near the bladder	Runs close to the lateral vaginal fornix, then enters the bladder wall obliquely

Five classic sites of ureteric injury



Left side shown (schematic)

1 PELVIC BRIM — IP ligament

oophorectomy / salpingo-oophorectomy

2 OVARIAN FOSSA

endometriosis, adnexal surgery

3 UNDER THE UTERINE ARTERY

hysterectomy — 1.5–2 cm lateral to the cervix

4 LATERAL VAGINAL FORNIX

vaginal hysterectomy, cervical surgery

5 URETEROVESICAL JUNCTION

anterior colporrhaphy, bladder dissection

Figure 3. Five classic places the ureter is injured.

RISK FACTORS

- Distorted anatomy: large or broad ligament fibroids, endometriosis, adhesions, malignancy
- Bleeding → hurried clamping
- Ureter not identified
- Injury rate ~0.5–1% (higher in oncology, complex cases)

PREVENTION

- **Identify the ureter at the start** — watch for peristalsis at the brim
- Skeletonise pedicles before clamping
- Good light and magnification
- **Stents** in complex cases
- **Cystoscopy** at the end (with IV dye to see ureteric jets)

3 Histology, Blood Supply, Lymph and Nerves

'Loin to groin' — T10–L2

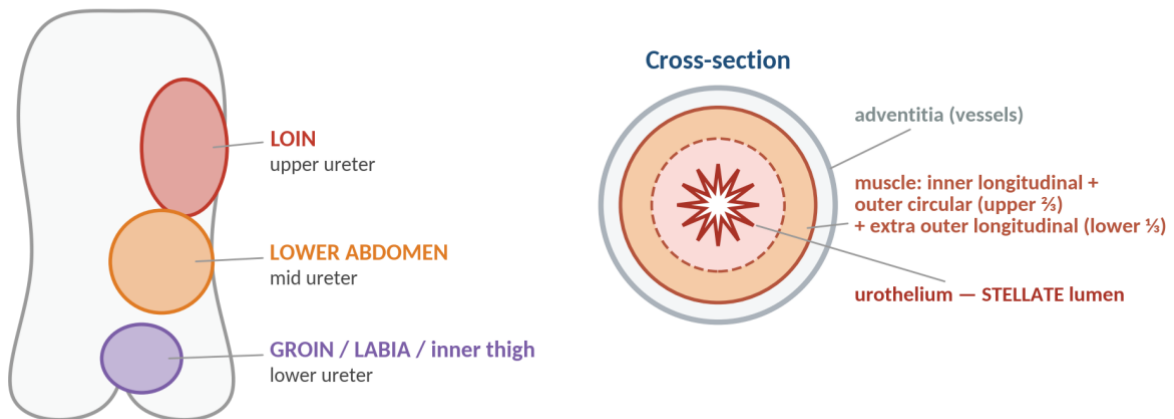
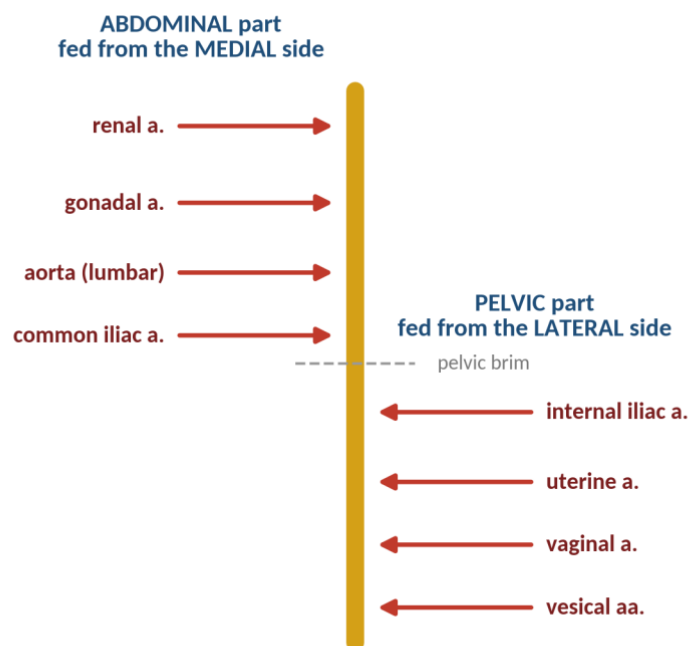


Figure 4. Where ureteric pain is felt — and a cross-section.

Layer	Detail
1. Mucosa	Transitional epithelium; stellate lumen when relaxed
2. Muscularis	Smooth muscle: inner longitudinal + outer circular in the upper $\frac{2}{3}$; extra outer longitudinal layer in the lower $\frac{1}{3}$ — peristalsis
3. Adventitia	Connective tissue carrying the vessels and nerves



Longitudinal plexus in the adventitia — don't strip (skeletonise) the ureter

Figure 5. Segmental blood supply — medial above the brim, lateral below it.

MNEMONIC / MEMORY HOOK

'Above the brim, from the middle; below the brim, from the side.' Mobilise the abdominal ureter from its lateral side and the pelvic ureter from its medial side.

LYMPH (segmental)

- Upper → lateral aortic / lumbar nodes
- Middle → common iliac nodes
- Lower → external + internal iliac nodes

NERVES

- Sympathetic **T10–L2**; parasympathetic S2–S4 (lower)
- Peristalsis is **myogenic** — pacemakers in the calyces
- Pain travels with sympathetics → 'loin to groin'

4 Embryology and Anomalies

- **Ureteric bud** grows from the lower mesonephric duct (~5 weeks) into the metanephric mesoderm — reciprocal induction forms the kidney and the collecting system (pelvis, calyces, collecting ducts).
- The ureters are absorbed into the bladder separately from the mesonephric ducts and open at the **trigone**; the mesonephric ducts open lower (vas deferens in males; regress in females).

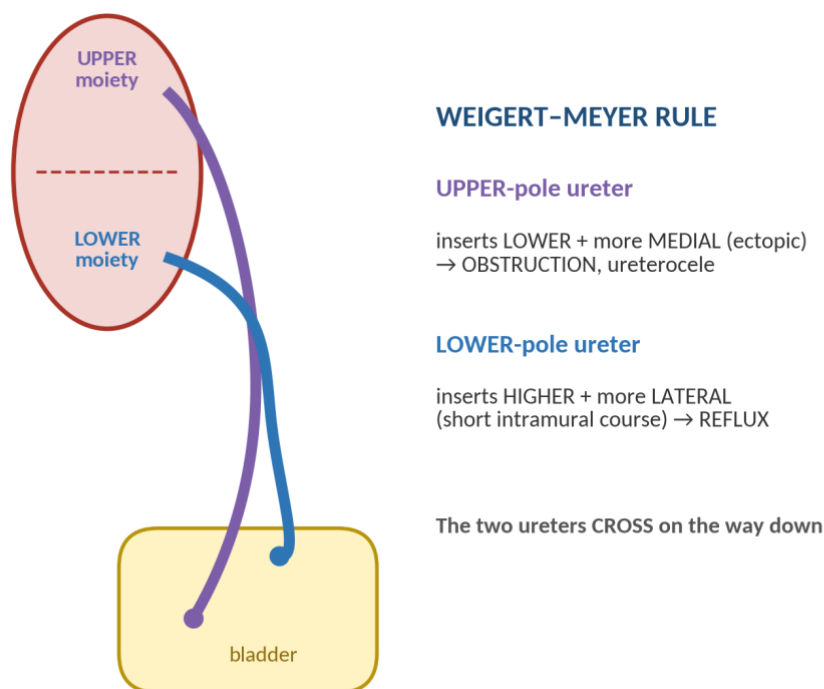


Figure 6. Duplex ureter and the Weigert–Meyer rule.

- Other anomalies: **PUJ obstruction**, **vesicoureteric reflux** (short intramural ureter), megaureter.
- Müllerian and mesonephric ducts develop together — **~30% of Müllerian anomalies have renal anomalies**.

5 Clinical Correlations

URETERIC INJURY AT SURGERY

- Crush/clamp (later ischaemia), transection, ligation, **thermal**, devascularisation
- Best found intra-operatively
- Later: ileus, fever, flank pain, urinoma, **ureterovaginal fistula**
- CT urogram / retrograde pyelogram
- Repair ± stent; reimplant if near the bladder; delayed: stent, nephrostomy, repair

CALCULI (renal colic)

- Calcium oxalate commonest; uric acid, struvite, cystine
- Loin-to-groin pain, haematuria, vomiting
- **Non-contrast CT KUB** = gold standard
- NSAID, fluids, tamsulosin; urology if not passing

OBSTRUCTION

- Stones, **gynae cancers** (cervix, ovary, endometrium), retroperitoneal fibrosis, nodes
- Hydroureter / hydronephrosis
- Stent or nephrostomy; treat the cause

PREGNANCY + OTHER

- Physiological dilatation from the 2nd trimester, **right > left** (sigmoid protects the left); more UTIs
- **VUR**: recurrent UTI, scarring
- Urothelial tumour: painless haematuria — nephroureterectomy

Imaging	Use
Plain X-ray	Most stones radiopaque
Non-contrast CT KUB	Gold standard for stones
Ultrasound	Hydronephrosis
IVU / CT urogram	Anatomy, level of obstruction
MR urography	Pregnancy — no radiation
Retrograde pyelogram	Precise, cystoscopic

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Numbers to know

25–30 cm Length	3–4 mm Diameter	L1–L2 PUJ level	1.5–2 cm Lateral to cervix
~1.5 cm Intramural part	3 Constrictions (P-B-V)	5 Classic injury sites	T10–L2 Pain / sympathetic

HIGH-YIELD CHECKLIST

- ☐ 25–30 cm; retroperitoneal throughout.
- ☐ PUJ (L1–L2) → psoas → over the common iliac bifurcation → side wall → broad ligament → under the uterine artery → bladder.
- ☐ Gonadal vessels cross IN FRONT of the ureter.
- ☐ Constrictions: PUJ, pelvic brim, VUJ (narrowest; commonest stone site).
- ☐ 1.5–2 cm lateral to the cervix at the internal os; uterine artery passes ANTERIOR (over) it.
- ☐ Five injury sites: IP ligament, ovarian fossa, uterine artery, lateral fornix, UVJ.
- ☐ Transitional epithelium; muscle 2 layers above, 3 layers in the lower third.
- ☐ Blood supply segmental: medial side above the brim, lateral side below.
- ☐ T10–L2 sympathetic; pain loin to groin.
- ☐ Ureteric bud from the mesonephric duct; duplex — Weigert–Meyer rule.
- ☐ Pregnancy: dilatation R > L.
- ☐ Cystoscopy at the end of complex surgery confirms ureteric jets.

Quick-fire self-test — cover the right-hand column

Question	Answer
Narrowest part of the ureter?	Vesicoureteric junction
Do the gonadal vessels cross in front of or behind the ureter?	In front
Where does the ureter enter the pelvis?	Over the common iliac bifurcation
Distance from the cervix at the internal os?	~1.5–2 cm lateral
Uterine artery — anterior or posterior to the ureter?	Anterior (over it)
Blood supply to the pelvic ureter comes from which side?	Lateral
Where does lower ureteric pain radiate?	Groin / labia / inner thigh
Embryological origin of the ureter?	Ureteric bud (mesonephric duct)
Weigert–Meyer: which moiety's ureter refluxes?	Lower pole
Gold-standard imaging for stones?	Non-contrast CT KUB
Which side dilates more in pregnancy?	Right

7 References

- Standring S, editor. Gray's Anatomy. 42nd ed. 2020.
- Moore KL et al. Clinically Oriented Anatomy. 8th ed. 2017.
- RCOG/BSUG. Joint position statement on ureteric injury at gynaecological surgery.