



PIPADOR REVISION

MRCOG Part 1 Revision Notes

The Anal Sphincter

ANATOMY • LECTURE 17

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG Part 1 Revision Notes

Lecture 17: The Anal Sphincter

Anatomy • Visual revision edition

COLOUR CODE USED THROUGHOUT THESE NOTES

INTERNAL SPHINCTER	EXTERNAL SPHINCTER	PUBORECTALIS	LONGITUDINAL COAT	MUCOSA
--------------------	--------------------	--------------	-------------------	--------

LEARNING OBJECTIVES — tick off as you go

- ☐ Describe the components of the anal sphincter complex.
- ☐ Distinguish the internal (smooth) from the external (striated) anal sphincter.
- ☐ Identify the three parts of the external anal sphincter.
- ☐ Recognise the role of puborectalis and the anorectal angle.
- ☐ Apply to OASI classification.
- ☐ Outline continence mechanisms and pathology.

1 Overview and the Anal Canal

IN ONE LINE: A 3–4 cm canal from the anorectal junction to the anal verge, wrapped in a sphincter complex that keeps us continent.

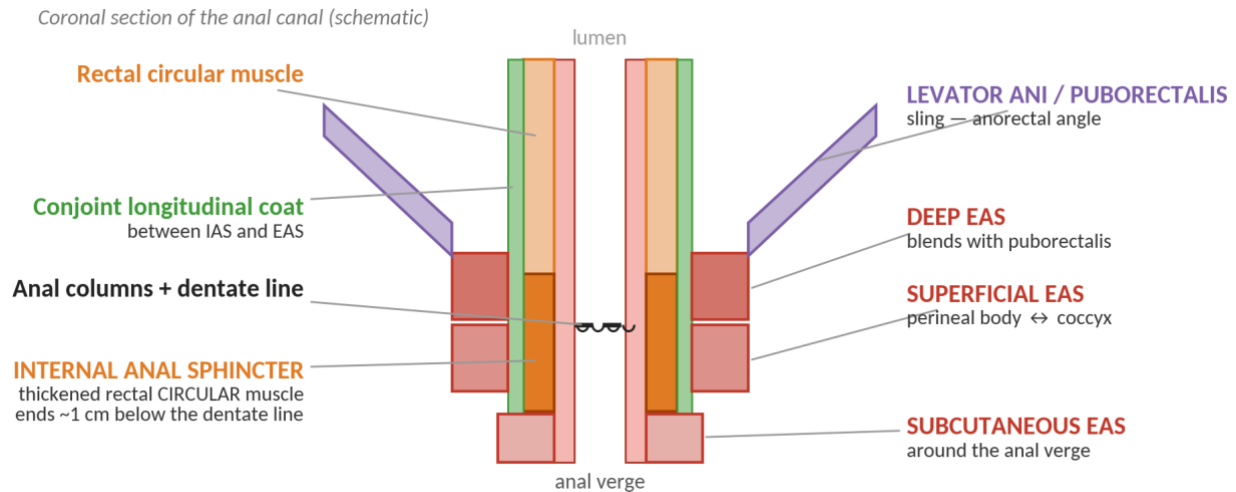


Figure 1. The sphincter complex in coronal section.

Five contributors to continence

IAS	EAS	PUBORECTALIS	ANAL CUSHIONS	SENSATION + REFLEXES
smooth • involuntary	striated • voluntary	sling • anorectal angle	vascular seal	sampling, RAIR

Internal landmarks (top to bottom)

Landmark	Detail
Anal columns (Morgagni)	Longitudinal mucosal folds in the upper canal
Anal valves + sinuses	Valves join the column bases; sinuses behind them receive anal glands

Landmark	Detail
PECTINATE (DENTATE) LINE	Line of the anal valves — the key embryological boundary (Lecture 16); a narrow transitional zone lies just above it
Pecten	~15 mm below the dentate line; non-keratinised stratified squamous epithelium
Anal verge	Junction with hair-bearing perianal skin

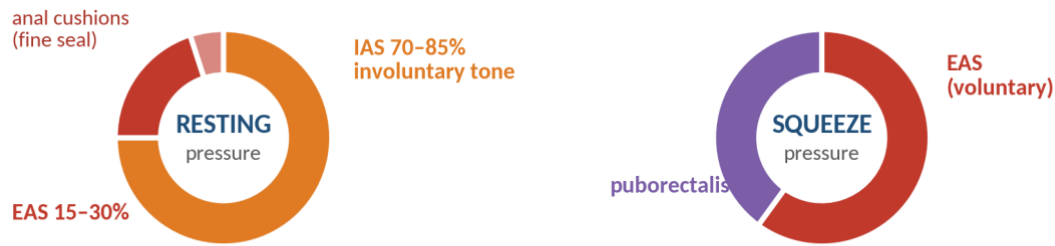
2 Internal vs External Anal Sphincter

	INTERNAL (IAS)	EXTERNAL (EAS)
Muscle	Smooth — thickened rectal circular layer	Striated (skeletal)
Extent	Upper ~¾ of the canal; lower edge ~1 cm below the dentate line, at the intersphincteric groove	Whole canal, outside the IAS; three parts: subcutaneous, superficial, deep
Thickness	~2–3 mm	~2.5–3 cm long
Control	Involuntary — sympathetic L1–L2 contracts; parasympathetic S2–S4 relaxes	Voluntary — inferior rectal branch of the pudendal nerve (S2–S4) + perineal branch of S4
Pressure	70–85% of RESTING pressure	15–30% of resting; most of SQUEEZE ; fatigues
Reflex	Relaxes with rectal distension — rectoanal inhibitory reflex (sampling)	Contracts on cough; deferral of defecation
If damaged	Passive soiling	Urge incontinence
Repair	End-to-end	Overlap or end-to-end (full thickness); end-to-end (partial)

MNEMONIC / MEMORY HOOK

INTERNAL = Involuntary, Inner, at rest. **EXTERNAL** = Extra squeeze, voluntary.

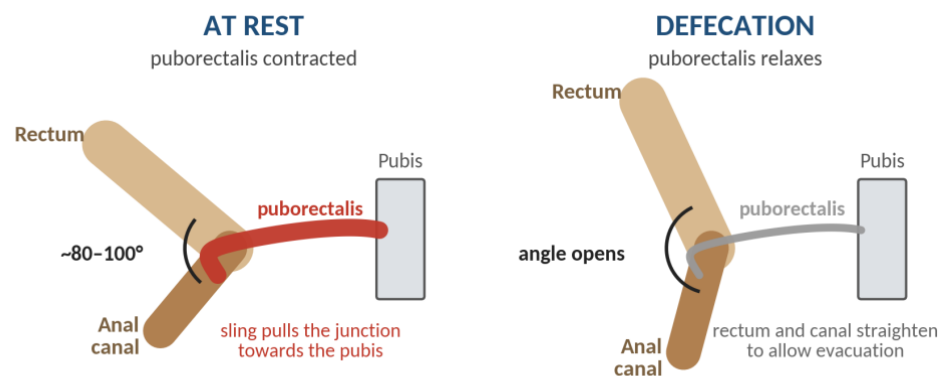
EAS part	Position and attachments
Subcutaneous	Around the anal verge, below the IAS; some fibres to skin
Superficial	Middle, elliptical — perineal body in front, anococcygeal raphe / coccyx behind
Deep	Upper, thicker — blends with puborectalis



Damaged IAS → passive soiling (lost resting tone). Damaged EAS → urge incontinence (lost squeeze).

Figure 2. Who provides resting vs squeeze pressure.

3 Puborectalis, Longitudinal Coat and Cushions



Sagittal view, anterior to the right (schematic)

Figure 3. Puborectalis holds the anorectal angle (from Lecture 2).

- **Puborectalis:** from the back of the pubis, U-sling round the anorectal junction, continuous with the deep EAS; supply S3–S4 direct + pudendal. Angle ~80–100° at rest, straightens (~110–180°) on defecation.
- **Conjoint longitudinal coat:** rectal longitudinal muscle + levator fibres between IAS and EAS; some pierce the subcutaneous EAS → **corrugator cutis ani**; suspends the canal.

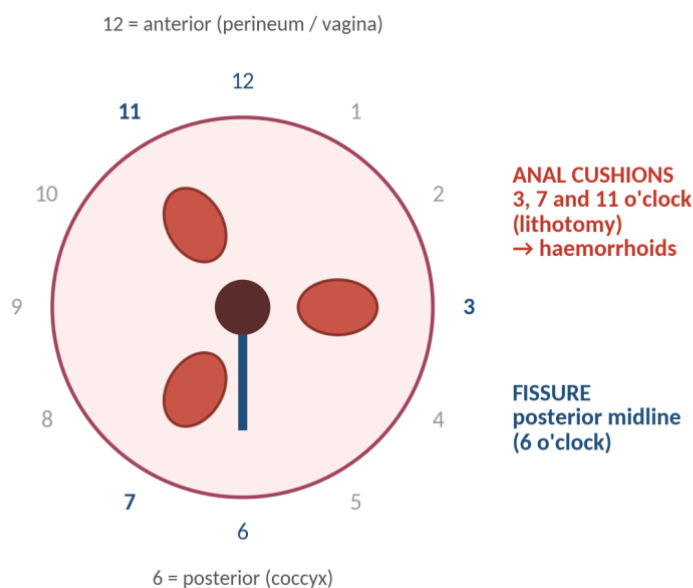


Figure 4. Anal cushions and the fissure site (lithotomy clock).

- **Anal cushions:** submucosal venous plexus, AV communications, smooth muscle — the 'gas-tight' fine seal; enlarged = haemorrhoids.

4 Vessels, Lymph and Nerves

Structure	Supply
Above pectinate line	Superior (IMA) + middle rectal (internal iliac) arteries • vein → portal • lymph → internal iliac
Below pectinate line	Inferior rectal a. (internal pudendal) • vein → systemic • lymph → superficial inguinal (anal cancer → groin nodes)
IAS	Autonomic — sympathetic L1–L2 (tone), parasympathetic S2–S4 (relax)
EAS	Inferior rectal branch of pudendal (S2–S4) + perineal branch of S4 — somatic
Puborectalis	Direct S3–S4 + pudendal — somatic
Mucosa above / below	Visceral, pain-insensitive / pudendal, pain-sensitive

5 Continence and Defecation

WHAT CONTINENCE NEEDS

- **Anatomy:** sphincters, sling, angle
- **Physiology:** rectal compliance, sensation, tone, reflexes
- **Nerves:** pudendal, autonomic, cord, cortex
- **Stool:** solid easiest; liquid, then gas, hardest

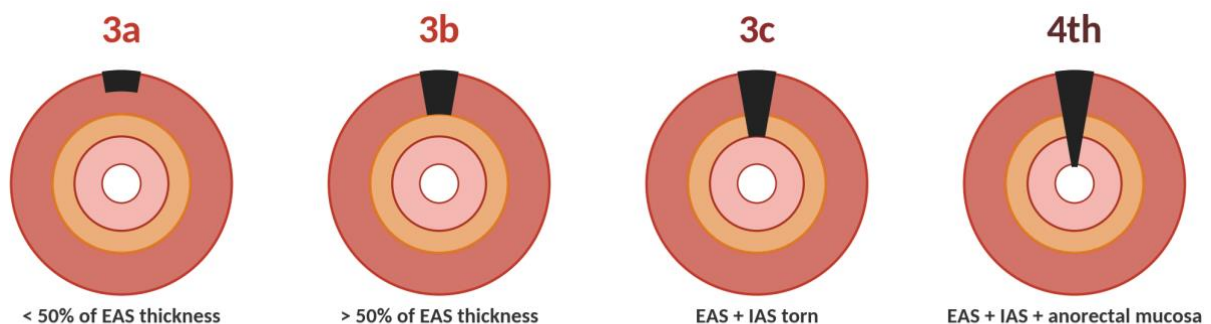
DEFECATION SEQUENCE

- Rectal filling → urge
- **RAIR:** IAS relaxes → canal 'samples' contents
- Right time: puborectalis + EAS relax, angle straightens, abdominal push
- Wrong time: EAS + puborectalis contract; rectum accommodates

6 Embryology

- Above the pectinate line: cloaca (hindgut **endoderm**). Below: proctodeum (**ectoderm**). Anal membrane ruptures at ~7–8 weeks.
- EAS from the cloacal sphincter (mesoderm); IAS is continuous with rectal smooth muscle.

7 Obstetric Anal Sphincter Injury (OASI)



Rings from outside in: EAS (red) • IAS (orange) • anorectal mucosa (pink). Black wedge = the tear (anterior, towards the perineum).

Figure 5. RCOG classification of 3rd- and 4th-degree tears.

Degree	Injury
1st	Skin and/or vaginal mucosa only
2nd	Perineal muscles; anal sphincter intact
3a	< 50% of EAS thickness
3b	> 50% of EAS thickness
3c	EAS and IAS
4th	EAS + IAS + anorectal mucosa

INCIDENCE + RISK (RCOG GTG 29)

- **2.9%** overall • **6.1%** first births • 1.7% multiparous
- Big baby, long second stage, **instrumental (esp. forceps)**, **midline episiotomy**, OP position, shoulder dystocia, Asian ethnicity

REPAIR

- In theatre, regional or GA
- **EAS**: overlap or end-to-end
- **IAS**: end-to-end, separately
- Mucosa: absorbable suture
- Antibiotics, laxatives, analgesia, physiotherapy; discuss future mode of birth

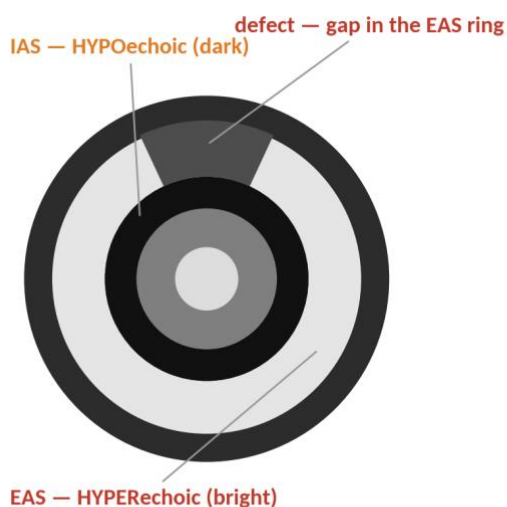
8 Faecal Incontinence and Other Conditions

CAUSES

- **Obstetric injury — commonest in women**
- Surgery: fistulotomy, sphincterotomy, haemorrhoidectomy
- Pudendal neuropathy, cord injury, diabetes, MS, cauda equina
- Impaction with overflow, prolapse, IBD/IBS, immobility

ASSESS + TREAT

- Wexner score; PR tone + squeeze, cough, bear-down
- **Endoanal USS = gold standard**; manometry; PNTML; MR defecography
- Diet, loperamide, PFMT + biofeedback, plugs
- Sphincteroplasty, **sacral neuromodulation (S3)**, artificial sphincter, stoma



Endoanal ultrasound (schematic) — gold standard

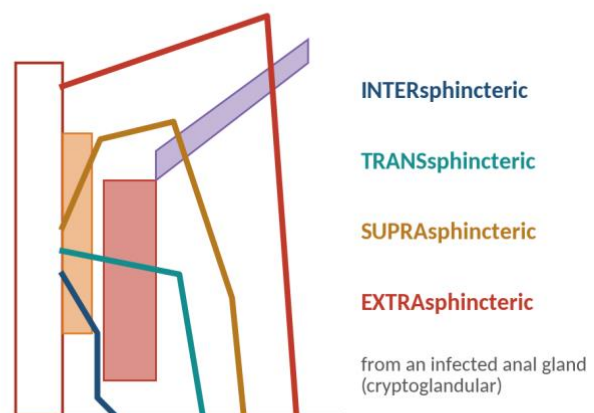
Parks classification of anal fistula

Figure 6. Endoanal ultrasound appearance, and anal fistula types.

FISSURE + HAEMORRHOIDS

- Fissure: **posterior midline** tear; painful defecation, bright blood — softeners, GTN/diltiazem, botox, lateral sphincterotomy (continence risk)
- Haemorrhoids: internal painless vs external painful when thrombosed

FISTULA, CANCER, IMPERFORATE ANUS

- Fistula: cryptoglandular; Parks types; fistulotomy (low) or seton (high)
- Anal cancer: squamous, **HPV 16**, inguinal nodes; chemoradiotherapy (Nigro)
- Imperforate anus ± rectovaginal fistula → PSARP

9 MRCOG Exam Pearls — Last-Minute Page**Numbers to know**

3–4 cm Anal canal	70–85% Resting pressure from IAS	80–100° Anorectal angle at rest	3, 7, 11 Cushions (lithotomy)
2.9% OASI overall	6.1% OASI first births	50% EAS: 3a vs 3b cut-off	S2–S4 Pudendal — EAS

HIGH-YIELD CHECKLIST

- ☐ IAS: smooth, involuntary, sympathetic L1–L2; 70–85% of resting pressure; ends ~1 cm below the dentate line.
- ☐ EAS: striated, voluntary, inferior rectal branch of pudendal (S2–S4); subcutaneous, superficial, deep.
- ☐ Puborectalis: sling; anorectal angle ~80–100°; relaxes on defecation.
- ☐ Pectinate line: endoderm/ectoderm; columnar/squamous; visceral/somatic; portal/systemic; internal iliac/inguinal.
- ☐ Anal cushions at 3, 7, 11 o'clock; haemorrhoids when enlarged.
- ☐ OASI: 3a <50% EAS, 3b >50% EAS, 3c + IAS, 4th + mucosa. Incidence 2.9%.
- ☐ Risk: big baby, forceps, midline episiotomy, OP, shoulder dystocia, Asian ethnicity.
- ☐ EAS repair overlap or end-to-end; IAS end-to-end.
- ☐ Endoanal USS = gold standard for sphincter integrity.
- ☐ Faecal incontinence in women: obstetric injury commonest.
- ☐ RAIR: rectal distension → IAS relaxes.

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

Question	Answer
Which sphincter gives most resting pressure?	Internal anal sphincter
The IAS is a thickening of which rectal layer?	Circular muscle
Nerve to the EAS?	Inferior rectal branch of the pudendal (S2–S4)
Which EAS part blends with puborectalis?	Deep
Tear through >50% of EAS, IAS intact — degree?	3b
Tear through EAS and IAS, mucosa intact?	3c
How is a torn IAS repaired?	End-to-end

Question	Answer
OASI incidence in first births?	6.1% (RCOG)
Gold-standard test for sphincter integrity?	Endoanal ultrasound
Where do anal fissures usually occur?	Posterior midline
Which reflex lets the canal 'sample' rectal contents?	Rectoanal inhibitory reflex

10 References

- Standring S, editor. Gray's Anatomy. 42nd ed. 2020.
- Moore KL et al. Clinically Oriented Anatomy. 8th ed. 2017.
- RCOG Green-top Guideline No. 29. Management of Third- and Fourth-Degree Perineal Tears. 2015.
- NICE CG49. Faecal incontinence in adults: management. 2007.