PIPADOR REVISION

MRCOG Part 1 Revision Notes

Foregut Development

EMBRYOLOGY • LECTURE 66

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG Part 1 Revision Notes

Lecture 66: Foregut Development

Embryology • Visual revision edition

COLOUR CODE USED THROUGHOUT THESE NOTES

FOREGUT TUBE	LIVER / BILIARY	PANCREAS	MESENTERIES / SEPTUM	CLINICAL

LEARNING OBJECTIVES — tick off as you go

- ☐ Define the foregut's boundaries, blood supply and derivatives.
- ☐ Describe stomach rotation, duodenal recanalisation, liver and pancreas buds.
- ☐ Explain diaphragm development and CDH.
- ☐ Recognise TOF/OA, pyloric stenosis, duodenal atresia, biliary atresia, annular pancreas and divisum.
- ☐ Link antenatal findings and neonatal presentations to each anomaly.

1 Boundaries and Supply

IN ONE LINE: *Foregut = oropharyngeal membrane → duodenum at the bile-duct entry. Coeliac trunk (pharynx from carotid branches). Buds: lungs, liver, gallbladder, pancreas.*

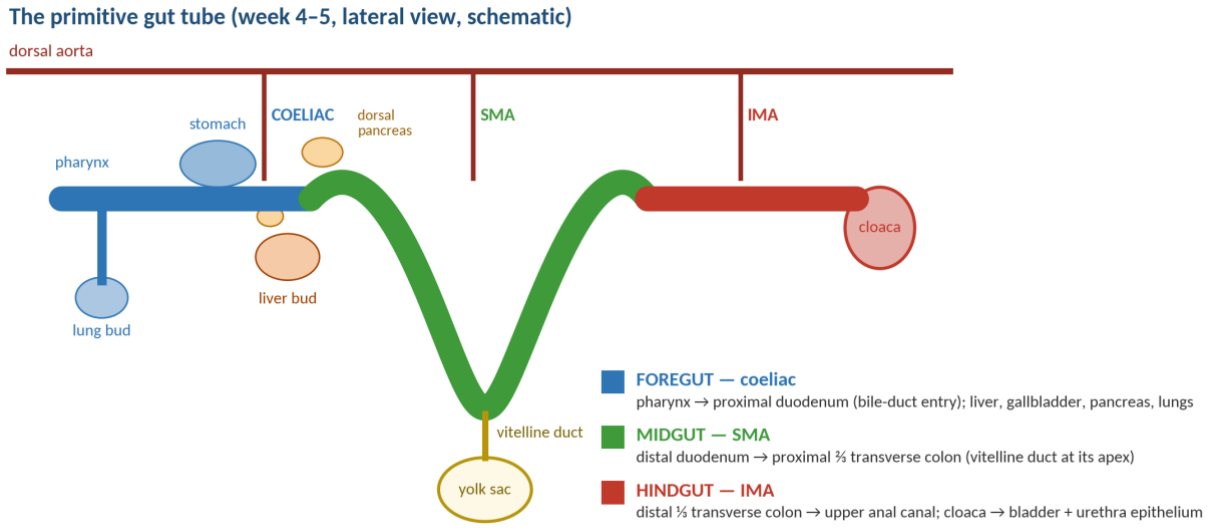


Figure 1. The gut tube (from Lecture 49).

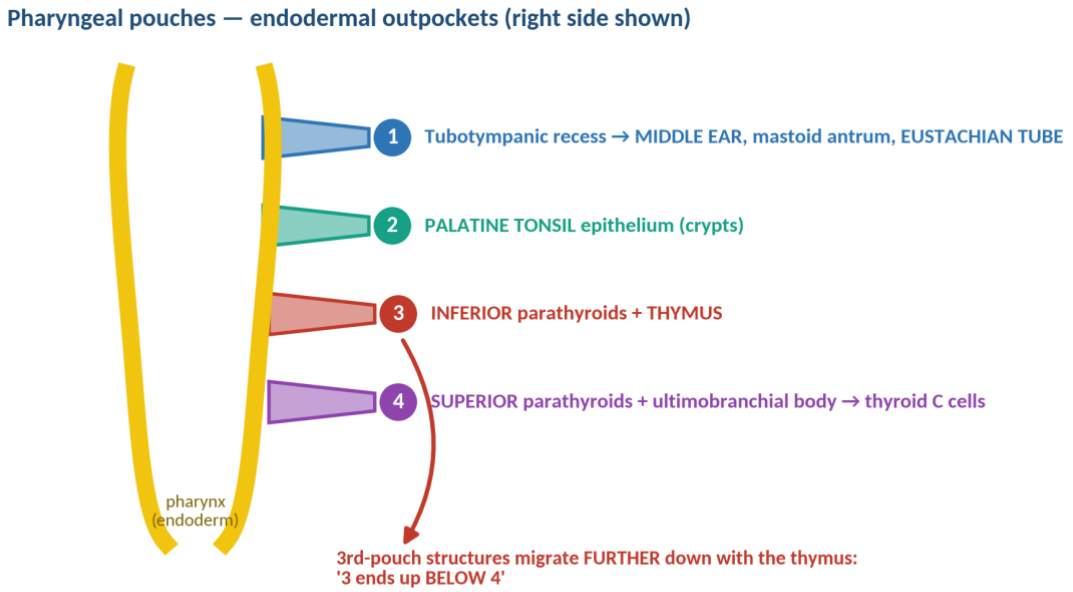


Figure 2. Pharyngeal pouches (from Lecture 49).

- **Branchial cleft cyst** — usually a 2nd-cleft remnant in front of sternocleidomastoid. **DiGeorge (22q11.2)** — pouches 3/4: thymus + parathyroids, conotruncal heart defects.

2 Oesophagus and Stomach

- **Oesophagus**: tracheo-oesophageal septum separates trachea (front) from oesophagus (back) by ~week 7; lengthens as the heart and lungs descend. Lining endoderm; **upper third skeletal muscle** (caudal pharyngeal-arch mesoderm), **lower third smooth muscle**, middle mixed.

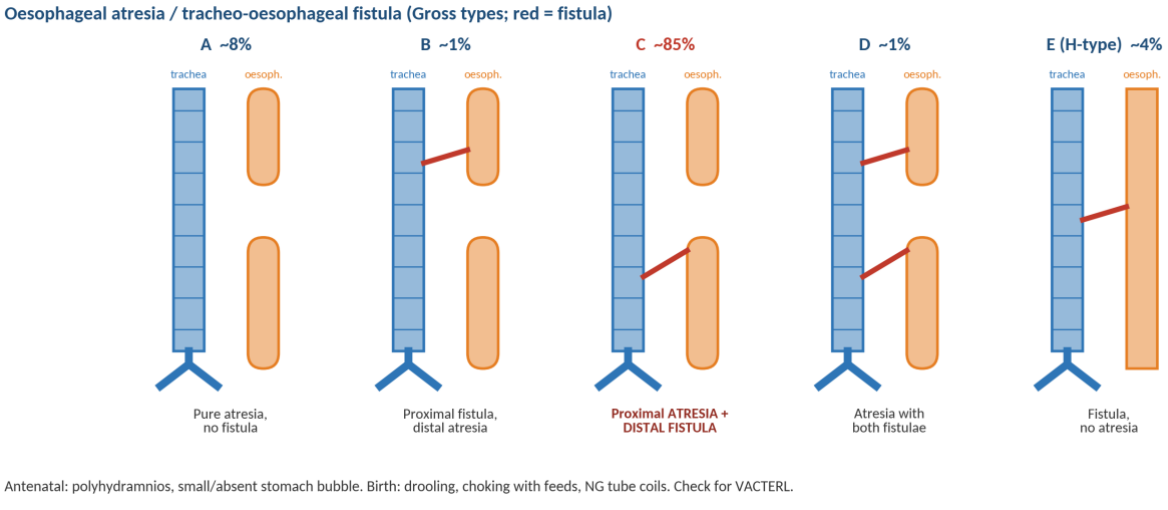
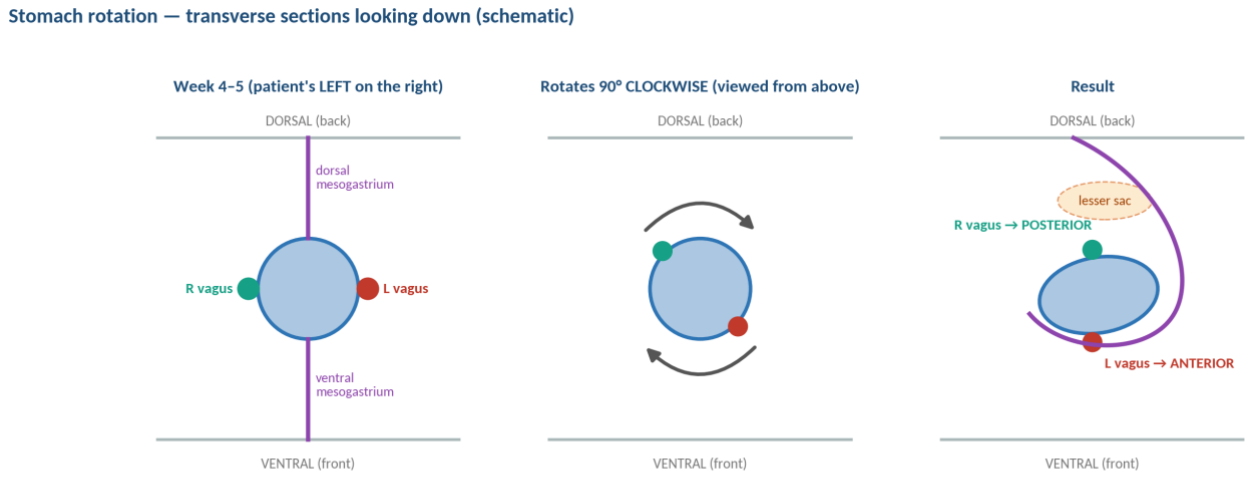


Figure 3. OA/TOF types (from Lecture 49).



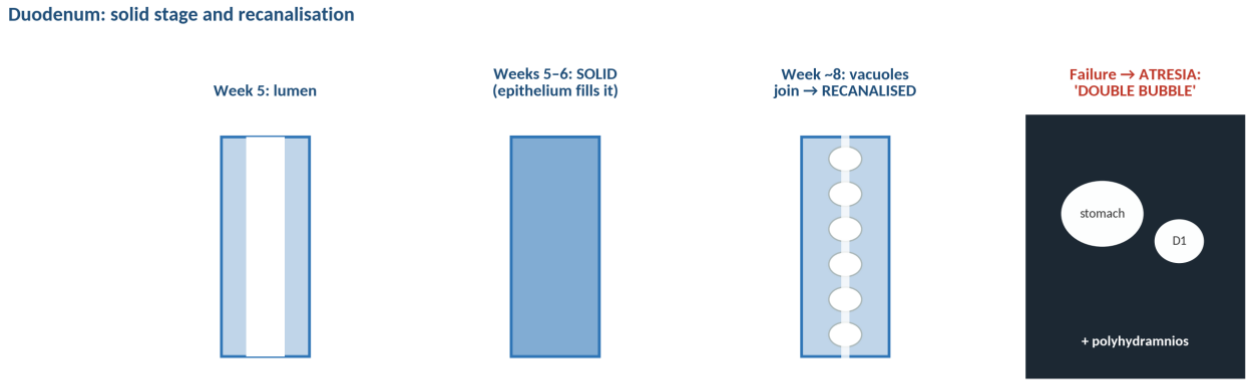
Also: dorsal mesogastrium → GREATER omentum (greater curvature grows faster); ventral mesogastrium → LESSER omentum + falciform ligament.

Figure 4. Stomach rotation.

MNEMONIC / MEMORY HOOK

'LARP' — **L**eft vagus → **A**nterior, **R**ight vagus → **P**osterior (the stomach turns so its left side faces forward).

3 Duodenum



Duodenal atresia: ~30% have TRISOMY 21 • bilious vomiting on day 1 (most lie below the ampulla) • duodenoduodenostomy. Annular pancreas can look the same.

Figure 5. Solid stage and recanalisation.

- Built from caudal foregut + cranial midgut, meeting at the **major papilla**. Solid by weeks 5–6, recanalised by ~week 8 — failure → **atresia or stenosis**.

4 Liver, Biliary Tree and Pancreas

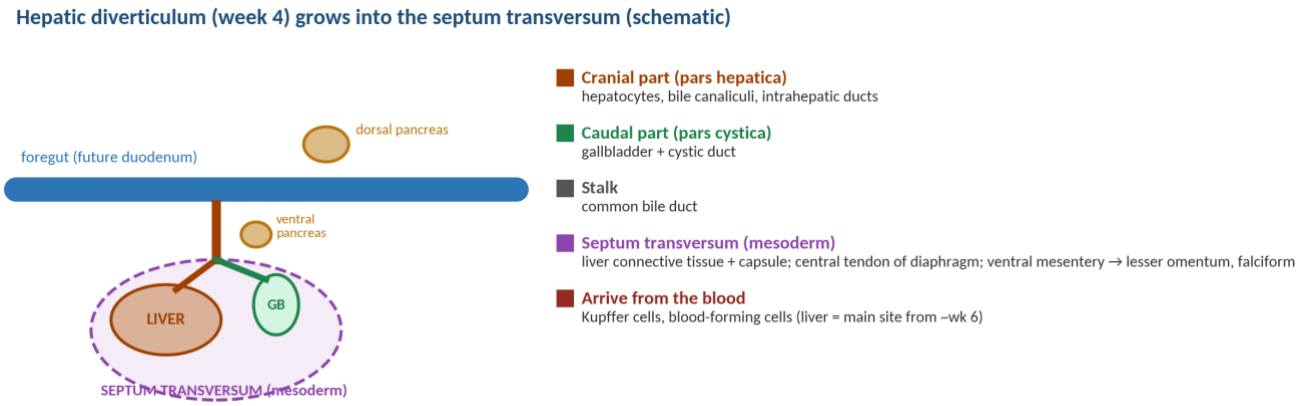


Figure 6. Hepatic diverticulum.

- **Fetal liver**: main blood-forming organ from ~week 6 through mid-pregnancy; **bile from ~week 12**; glycogen stores build in the third trimester.

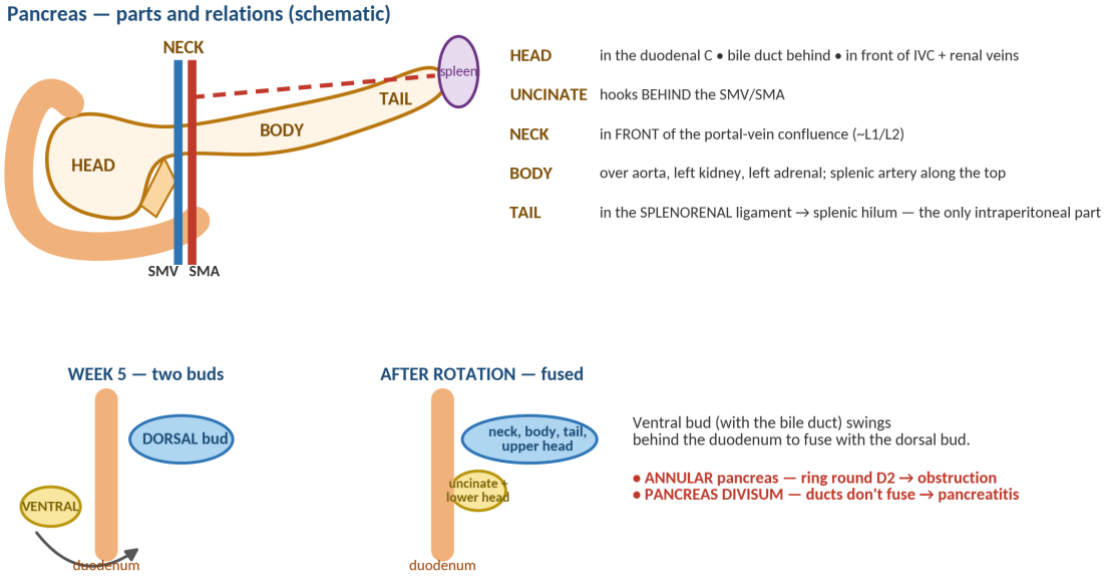


Figure 7. Pancreatic buds and rotation (from Lecture 30).

Feature	Detail
Ventral bud	With the bile duct → uncinate + lower head; swings behind the duodenum to fuse
Dorsal bud	Upper head, neck, body, tail
Main duct (Wirsung)	Ventral duct + distal dorsal duct → with the CBD at the ampulla (major papilla)
Accessory duct (Santorini)	Proximal dorsal duct → minor papilla
Islets	From endodermal pancreatic progenitors (PDX1, then NEUROG3 switches on endocrine fate) — not from acinar cells; α glucagon, β insulin (from ~10–12 wk), δ somatostatin, PP

5 Diaphragm and CDH

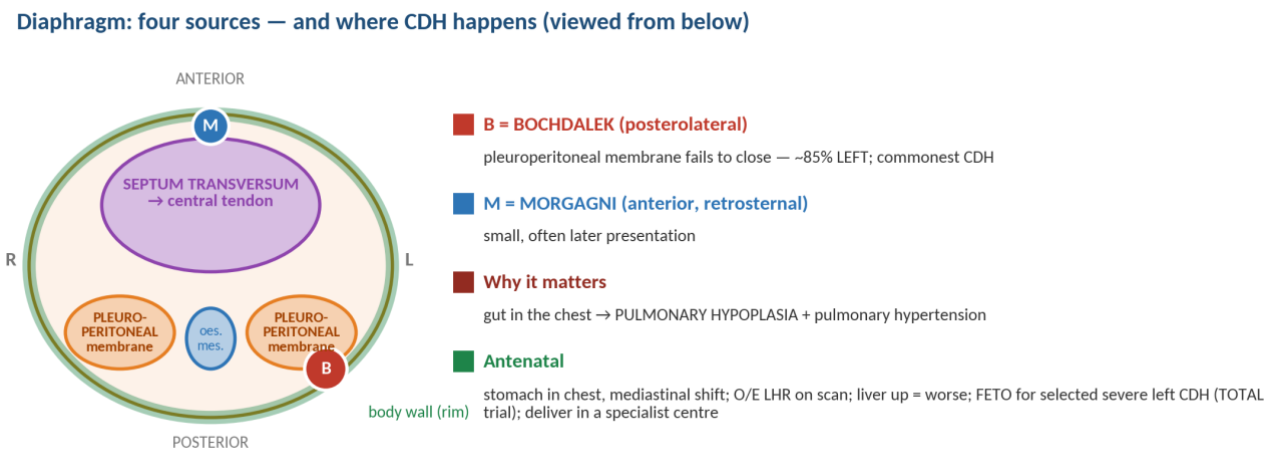


Figure 8. Diaphragm sources and CDH sites.

6 Anomalies and Presentations

Condition	Key points
OA / TOF	Septum defect; type C (~85%): proximal atresia + distal fistula. Polyhydramnios, small/absent stomach bubble; NG tube coils; VACTERL
Pyloric stenosis	Muscle hypertrophy (not a true malformation); boys, first-born, 3–6 weeks; projectile non-bilious vomiting, olive, hypochloraemic hypokalaemic metabolic alkalosis; link with early erythromycin; pyloromyotomy
Duodenal atresia	Failed recanalisation; double bubble + polyhydramnios; ~30% T21; bilious vomiting day 1
Annular pancreas	Bifid ventral bud encircles D2 → obstruction (double bubble); Down syndrome link
Pancreas divisum	Ducts don't fuse — most juice via the minor papilla → pancreatitis in some
Biliary atresia	Progressive obliteration of extrahepatic ducts; pale stools; Kasai before ~60 days; many need transplant
Choledochal cyst	Todani I–V; pain, jaundice, mass; malignancy risk → excision
CDH	Bochdalek (left ~85%) → pulmonary hypoplasia; specialist-centre delivery; FETO for selected cases

Foregut problems in the newborn — the classic patterns

Condition	When	Clues
TOF / oesophageal atresia	at birth	drooling, choking/cyanosis with feeds, NG tube COILS
Duodenal atresia / annular pancreas	day 1	BILIOUS vomiting, double bubble, often T21
Pyloric stenosis	3–6 weeks	PROJECTILE NON-bilious vomiting, olive, hypochloraemic alkalosis → pyloromyotomy
Biliary atresia	> 2 weeks (term)	prolonged jaundice, PALE stools, dark urine → Kasai before ~60 days
Congenital diaphragmatic hernia	at birth	respiratory distress, scaphoid abdomen, bowel sounds in chest

Figure 9. Neonatal patterns.

EXAM HOOK

Antenatal: **polyhydramnios** → think upper-GI obstruction (OA/TOF, duodenal atresia) or poor swallowing. **Double bubble** → duodenal atresia → offer karyotype (T21). **Echogenic bowel** → CF, CMV, T21, swallowed blood (bleeding), FGR.

★ PEARL

Vomiting colour tells the level: non-bilious = above the ampulla (pyloric stenosis, OA); bilious = below (duodenal atresia, malrotation).

Severe OA/TOF or CDH → **deliver where there is neonatal surgery and intensive care**.

7 MRCOG Exam Pearls — Last-Minute Page

Numbers to know

Week 4 Liver + pancreas buds	**Week 7** TO septum complete	**Wk 5–8** Duodenum solid → open	**90°** Stomach rotation
~85% TOF type C	**~30%** Duodenal atresia with T21	**3–6 wk** Pyloric stenosis	**~60 days** Kasai timing

HIGH-YIELD CHECKLIST

- ☐ Foregut: oropharyngeal membrane → bile-duct entry; coeliac trunk.
- ☐ TO septum → OA/TOF (type C ~85%).
- ☐ Stomach rotates 90° clockwise: LARP.
- ☐ Dorsal mesogastrium → greater omentum; ventral → lesser omentum + falciform.
- ☐ Duodenum solid then recanalised; atresia + T21.
- ☐ Hepatic diverticulum: liver, gallbladder, CBD; septum transversum = connective tissue + central tendon.
- ☐ Ventral pancreas → uncinate + lower head; Wirsung vs Santorini.
- ☐ Annular pancreas (bifid ventral bud) vs divisum (no duct fusion).
- ☐ CDH: Bochdalek, left, pulmonary hypoplasia.
- ☐ Biliary atresia → Kasai by ~60 days; pyloric stenosis → alkalosis.

Self-assessment — cover the right-hand column

Question	Answer
Where does the foregut end?	Duodenum at the entry of the bile duct
Artery of the foregut?	Coeliac trunk
Which vagus supplies the anterior stomach, and why?	Left — the stomach rotates 90° clockwise
Adult derivative of the dorsal mesogastrium?	Greater omentum
Mechanism of duodenal atresia?	Failed recanalisation
Chromosomal association of duodenal atresia?	Trisomy 21 (~30%)
Part of the pancreas from the ventral bud?	Uncinate process + lower head
Where does the accessory duct open?	Minor duodenal papilla
Commonest CDH type and side?	Bochdalek, left
Acid–base picture in pyloric stenosis?	Hypochloraemic hypokalaemic metabolic alkalosis

8 References

- Sadler TW. Langman's Medical Embryology. 14th ed. 2019.
- Deprest JA et al. Fetal surgery for severe left CDH (TOTAL trial). N Engl J Med 2021.
- NICE CG98. Jaundice in newborn babies under 28 days. 2010 (updated 2023).