PIPADOR REVISION

MRCOG Part 1 Revision Notes

Fetal Gastrointestinal Physiology

PHYSIOLOGY • LECTURE 142

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG PART 1 REVISION NOTES | PHYSIOLOGY

142 Fetal Gastrointestinal Physiology

Gut development, swallowing and amniotic fluid, digestive maturation, meconium, the fetal liver and AFP

6–10 wk	≈ 11 wk	500–1000 mL	32–34 wk
Physiological midgut herniation	Fetal swallowing begins	Swallowed per day at term	Suck–swallow–breathe coordination

■ KEY FACTS: Learning objectives

- Describe embryological development of the gut and the basis of common anomalies.
- Describe fetal swallowing and its role in amniotic fluid regulation.
- Describe maturation of fetal digestive, absorptive and motor function, and meconium.
- Describe fetal liver function, bilirubin handling and alpha-fetoprotein.
- Relate fetal GI physiology to prenatal ultrasound findings and neonatal disorders.

142.1 Development of the gut

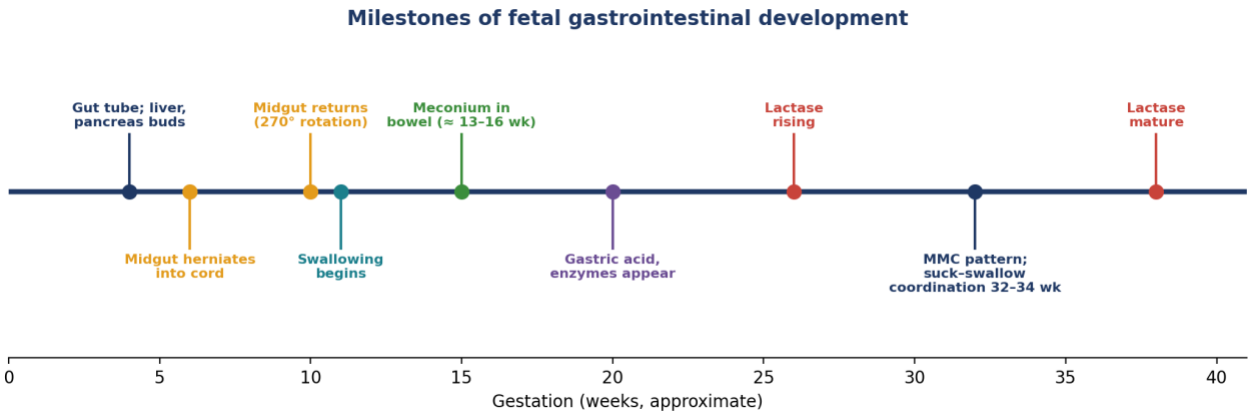


Figure 142.1 — Milestones of fetal GI development

Region	Derivatives	Artery	Developmental anomalies
Foregut	Oesophagus → 2nd part of duodenum; liver, gallbladder, pancreas	Coeliac trunk	Oesophageal atresia ± TOF (tracheo-oesophageal septum); duodenal atresia (failed recanalisation; ≈ 30% trisomy 21); annular pancreas; pyloric stenosis (postnatal)
Midgut	Duodenum (distal) → proximal ⅔ transverse colon	Superior mesenteric	Herniates into cord 6–10 wk, rotates 270° anticlockwise, returns by ≈ 12 wk → malrotation/volvulus, exomphalos; Meckel's diverticulum (vitelline duct)
Hindgut	Distal ⅓ transverse colon → upper anal canal	Inferior mesenteric	Anorectal malformations; Hirschsprung disease (failed neural-crest migration → aganglionic distal bowel)

	Exomphalos (omphalocele)	Gastroschisis
Defect	Midgut fails to return; covered by membrane (sac); cord inserts into sac	Full-thickness defect right of the cord; no sac — bowel floats free
Associations	Chromosomal (≈ 30–50%: trisomy 13, 18), cardiac, Beckwith–Wiedemann	Young maternal age, smoking, recreational drugs; usually isolated
Prenatal	↑ MSAFP; karyotype and echo	↑↑ MSAFP; FGR; bowel dilatation/thickening

	Exomphalos (omphalocele)	Gastroschisis
Prognosis	Depends on associated anomalies	Good (> 90% survival); bowel complications

142.2 Swallowing and amniotic fluid

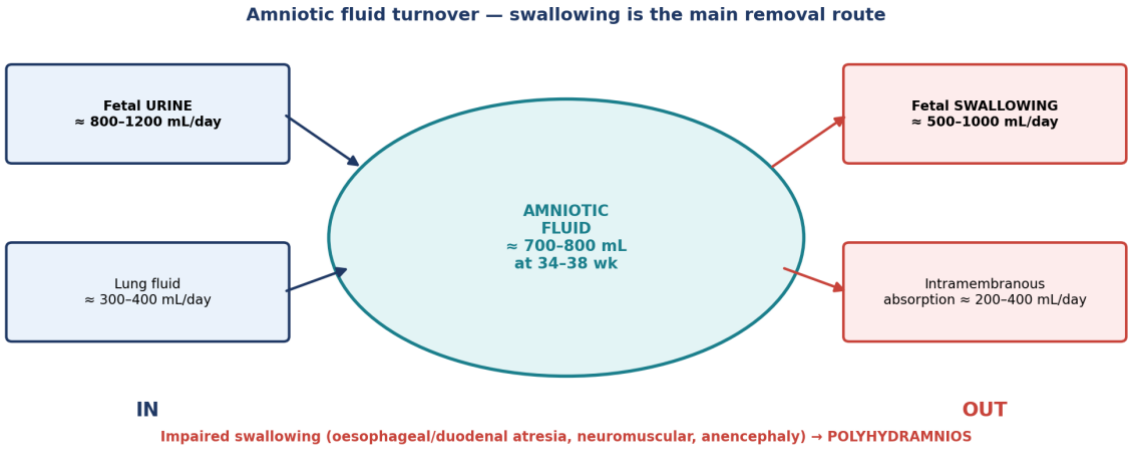


Figure 142.2 — Amniotic fluid production and removal near term

- Swallowing starts at ≈ **11 weeks** and increases to **≈ 500–1000 mL/day** (≈ 200–250 mL/kg/day) at term — the **main route of amniotic fluid removal**.
- Swallowed fluid provides ≈ **10–15% of fetal protein requirements** and **growth factors (EGF, IGF, TGF)** that are **trophic for gut mucosa** — bowel atresia proximal to an obstruction shows mucosal hypertrophy; distal bowel is small ('microcolon').
- **Polyhydramnios** from impaired swallowing/GI obstruction: oesophageal atresia (**small/absent stomach bubble**), **duodenal atresia ('double bubble')**, CDH, neuromuscular disorders, anencephaly. Higher obstructions cause polyhydramnios earlier.

142.3 Digestive and absorptive maturation

Function	Maturation	Clinical consequence
Brush-border enzymes	Sucrase, maltase near adult by ≈ 28–34 wk; lactase rises late (3rd trimester)	Preterm infants have relative lactose intolerance but tolerate breast milk
Pancreatic enzymes	Trypsin present early; amylase and lipase low at birth	Breast milk lipase and salivary/lingual lipase compensate
Bile acid pool	Small; immature ileal reabsorption	Fat malabsorption in preterm (MCT in preterm formula)
Gastric acid	Low; rises after birth	↑ Infection susceptibility
Motility	Peristalsis from ≈ 12 wk; organised MMC by ≈ 32–34 wk; suck–swallow–breathe ≈ 32–34 wk	Feeding intolerance; tube feeding < 34 wk
Gut barrier & immunity	Immature tight junctions; ↓ IgA	NEC in preterm (formula feeding, ischaemia, dysbiosis) — breast milk protective

142.4 Meconium

Composition
Swallowed AF, lanugo, vernix, shed cells, bile, mucus

Green colour
Biliverdin / bile pigments

From ≈ 13–16 wk
Present in fetal bowel

Within 24–48 h
Normal first passage after birth

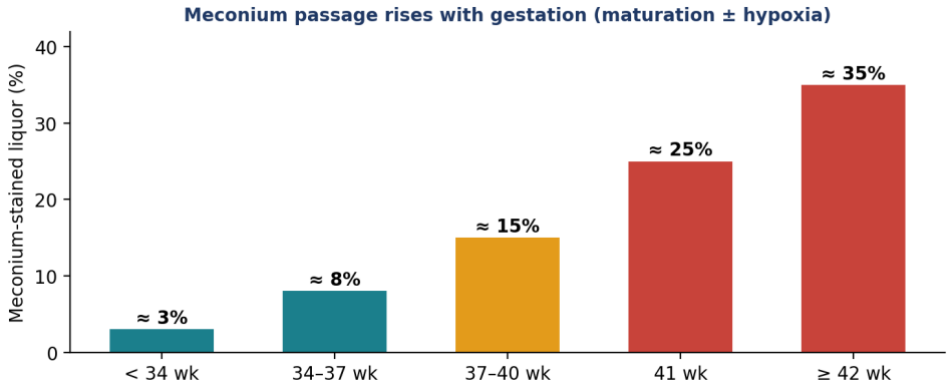


Figure 142.3 — Meconium-stained liquor by gestation (approximate)

Situation	Interpretation
Term/post-term meconium	Maturation of motility (↑ motilin, vagal tone) ± hypoxic stress; NICE: significant meconium → continuous CTG, neonatologist at birth
Preterm meconium	Unusual — consider Listeria monocytogenes
Meconium aspiration syndrome	Gasping in utero/at birth → airway obstruction, chemical pneumonitis, surfactant inactivation, PPHN
Delayed passage (> 48 h)	Hirschsprung disease, meconium ileus (≈ 15–20% of CF neonates), meconium plug, hypothyroidism
Echogenic bowel on ultrasound	CF, CMV, trisomy 21, swallowed blood (intra-amniotic bleeding), FGR — offer CF and karyotype testing, CMV serology

142.5 Fetal liver

Function	Fetal physiology	Neonatal relevance
Haematopoiesis	Main site mid-gestation (Lecture 136)	Hepatosplenomegaly in fetal anaemia
Bilirubin	Unconjugated bilirubin cleared across the placenta; UGT1A1 low	Physiological jaundice after birth (day 2–3); haemolytic jaundice < 24 h
Glycogen	Stored mainly in the 3rd trimester (liver, heart, muscle)	Hypoglycaemia in preterm, FGR, infants of diabetic mothers (hyperinsulinaemia)
Protein synthesis	Albumin; coagulation factors (low vitamin K-dependent)	Vitamin K at birth
Gluconeogenesis	Minimal in utero (glucose from mother)	Switched on after birth (cortisol, glucagon, catecholamines)
Drug metabolism	Immature cytochrome P450	Neonatal drug toxicity (e.g. chloramphenicol — 'grey baby')

Alpha-fetoprotein (AFP)

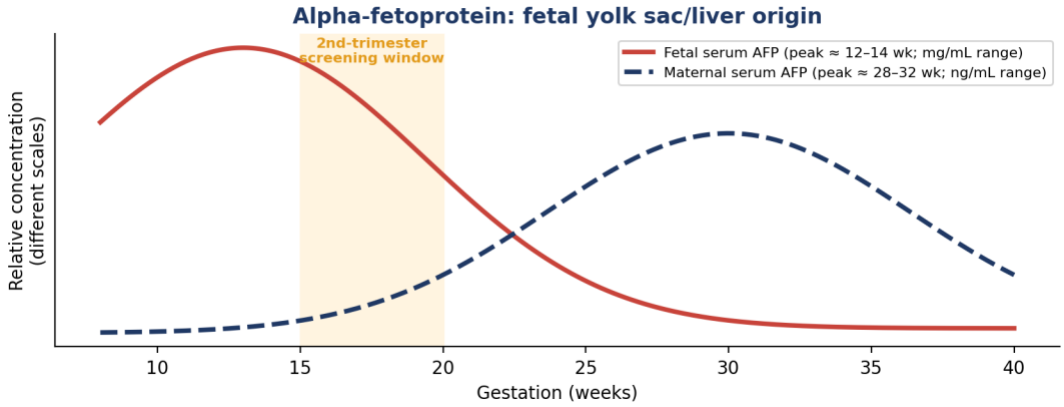


Figure 142.4 — Fetal and maternal serum AFP across gestation

↑ Maternal serum AFP	↓ Maternal serum AFP
Open neural tube defects, gastroschisis/exomphalos, multiple pregnancy, wrong dates (underestimated), fetal death, placental abnormalities (adverse outcome marker), congenital nephrosis	Trisomy 21 (and 18), overestimated gestation, maternal obesity, diabetes

AFP is made by the **yolk sac then fetal liver** (and GI tract); it is the fetal equivalent of albumin. Fetal serum peaks at ≈ 12–14 weeks; it reaches maternal blood via the placenta and amniotic fluid, so maternal levels peak later (≈ 28–32 weeks). Used in the second-trimester **quadruple test** (AFP, hCG, uE3, inhibin-A).

142.6 Must-know summary

■ EXAM TIP

- Foregut = coeliac; midgut = SMA; hindgut = IMA. Midgut herniates **6–10 wk**, rotates **270° anticlockwise**, returns by ≈ 12 wk.
- **Exomphalos** (sac, chromosomal) vs **gastroschisis** (no sac, right of cord, young mothers, isolated).
- Swallowing begins ≈ 11 wk; ≈ **500–1000 mL/day** at term; failure → **polyhydramnios**. **Double bubble** = duodenal atresia (trisomy 21).
- Lactase matures late; MMC and suck–swallow coordination at **32–34 wk**.
- Meconium: rare preterm (think **Listeria**); delayed passage → Hirschsprung, CF; echogenic bowel → CF/CMV/T21.

■ MNEMONIC / MEMORY AID

Meckel's — 'rule of 2s': 2% of population, 2 feet from ileocaecal valve, 2 inches long, 2 tissue types (gastric, pancreatic), symptomatic by age 2. **Gastroschisis: 'G' goes it alone (no sac, isolated)**.