PIPADOR REVISION

MRCOG Part 1 Revision Notes

Development of the Placenta

EMBRYOLOGY • LECTURE 51

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG Part 1 Revision Notes

Lecture 51: Development of the Placenta

Embryology • Visual revision edition

COLOUR CODE USED THROUGHOUT THESE NOTES

TROPHOBLAST	MATERNAL BLOOD	FETAL BLOOD	DECIDUA	CLINICAL

LEARNING OBJECTIVES — tick off as you go

- ☐ Describe villus development and the villous vs extravillous trophoblast lineages.
- ☐ Explain spiral artery remodelling and its failure in pre-eclampsia and FGR.
- ☐ Describe the structure of the term placenta, the placental barrier and the two circulations.
- ☐ Explain transfer of gases, nutrients, antibodies and drugs, and the placental hormones.
- ☐ Know the basics of amniotic fluid.
- ☐ Apply to praevia, accreta spectrum, abruption, pre-eclampsia, vasa praevia, GTD and twin chorionicity.

1 Early Development

IN ONE LINE: *A HAEMOCHORIAL, discoid placenta: fetal trophoblast is bathed directly in maternal blood. ~500 g at term (about 1/6 of fetal weight).*

- Recap (Lectures 44–46): trophoblast Day 5 → syncytio/cytotrophoblast Day 8 → lacunae Day 9 → maternal sinusoids tapped Days 11–13.

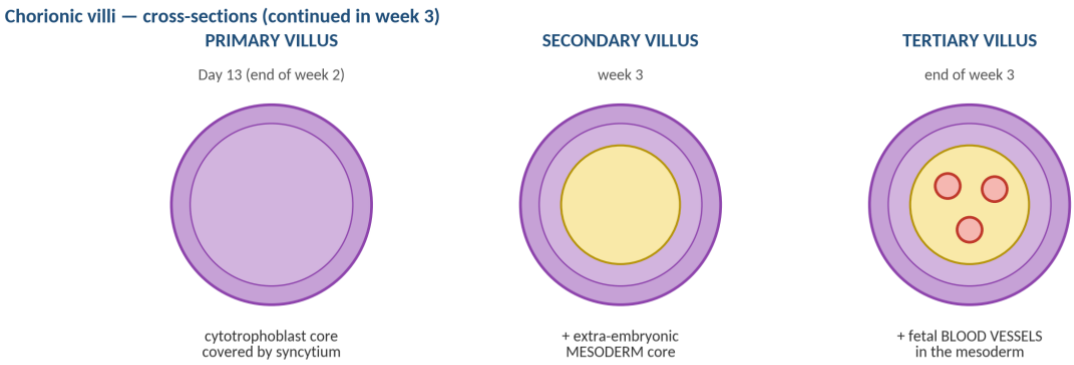


Figure 1. Primary (Day 13) → secondary (Day 16) → tertiary (Day 21) villi (from Lecture 45).

- **Anchoring (stem) villi** reach the decidua; their cytotrophoblast breaks through the syncytium to form the **cytotrophoblastic shell**. **Terminal villi** are where exchange happens.

VILLOUS TROPHOBLAST

- Covers the villi
- Exchange + hormone production (hCG, hPL, steroids)

EXTRAVILLOUS TROPHOBLAST (EVT)

- Leaves the anchoring villi to invade
- **Interstitial** EVT → decidua + inner third of myometrium (anchors)
- **Endovascular** EVT → remodels **spiral arteries**

2 Spiral Artery Remodelling

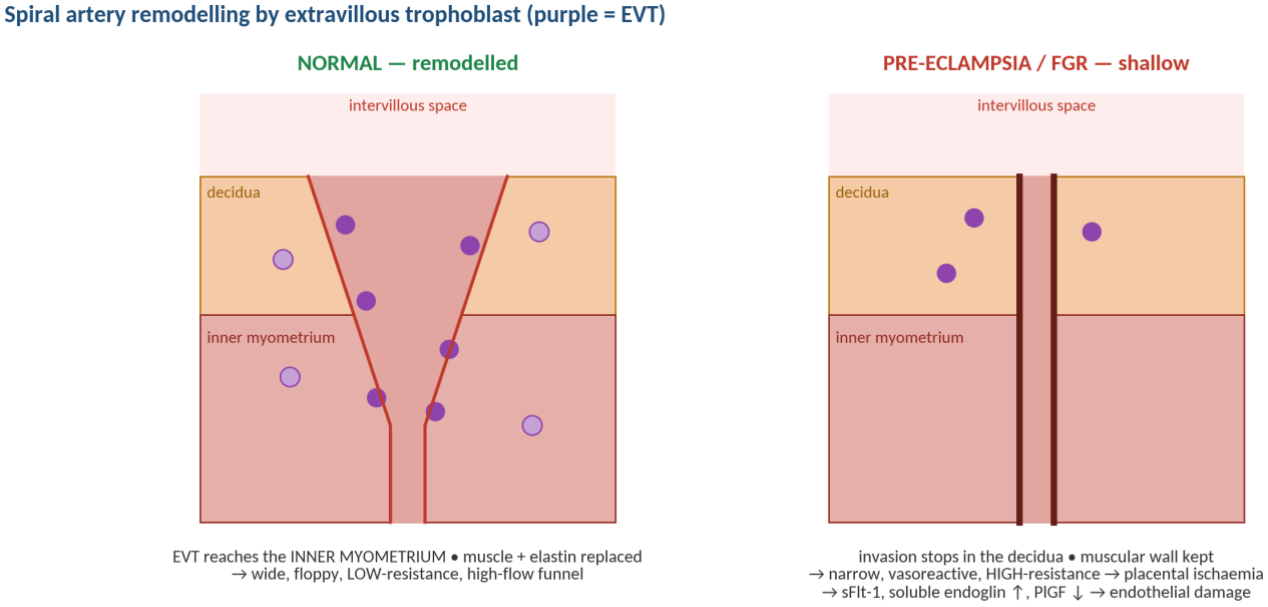


Figure 2. Normal vs shallow remodelling.

- Classically described in **two waves**: decidual segments at **8–10 weeks**, myometrial segments at **16–18 weeks** (many now see it as one continuous process). Result: **~10-fold** rise in uteroplacental flow.

> **EXAM HOOK**
>
> **Pre-eclampsia and FGR**: shallow invasion (the myometrial segments aren't remodelled) → high-resistance vessels → placental ischaemia → **sFlt-1 and soluble endoglin ↑, PlGF ↓** → maternal endothelial dysfunction. Prevention: **aspirin 75–150 mg nightly from 12 weeks** in high-risk women (NICE); **PlGF-based testing** helps assess suspected pre-eclampsia.

3 The Term Placenta

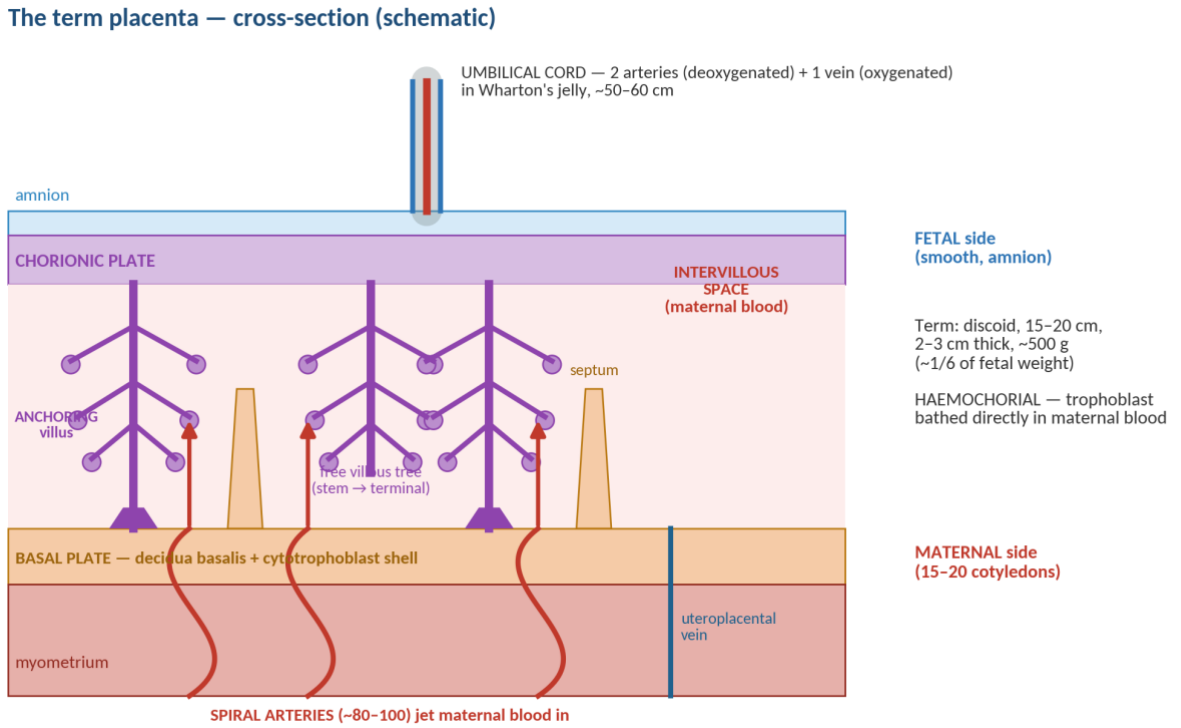


Figure 3. Cross-section of the term placenta.

Part	Detail
Size	Discoid, 15–20 cm, 2–3 cm thick, ~500 g
Fetal surface	Smooth, covered by amnion; cord inserts centrally/paracentrally
Maternal surface	15–20 cotyledons separated by septa; covered by decidua basalis
Cord	2 arteries + 1 vein in Wharton's jelly, ~50–60 cm
Intervillous space	Maternal blood from ~80–100 spiral arteries (~70–80 → ~10 mmHg); drained by uteroplacental veins
Uteroplacental flow	~500–700 mL/min at term (~10% of cardiac output)

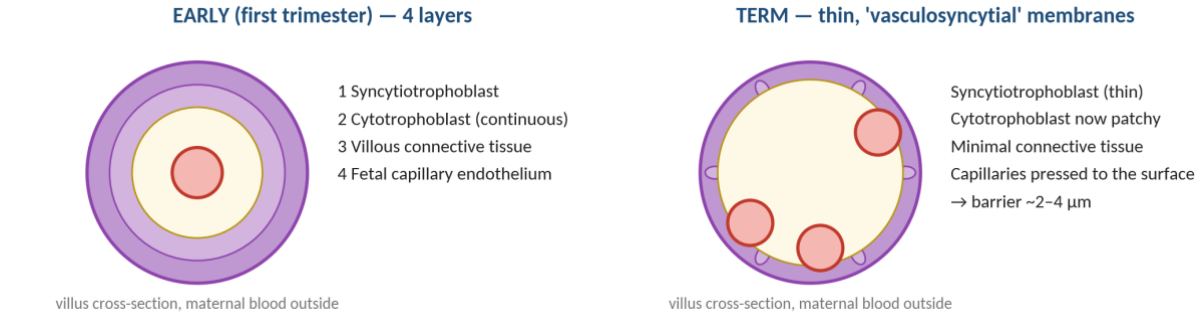


Figure 4. The barrier thins through pregnancy.

- **Fetal circulation**: umbilical **arteries** (from the internal iliacs, deoxygenated) → villous capillaries → single umbilical **vein** (oxygenated) → ductus venosus → IVC. Maternal and fetal blood **don't mix** — apart from small fetomaternal bleeds (the basis of rhesus sensitisation).

4 Placental Functions

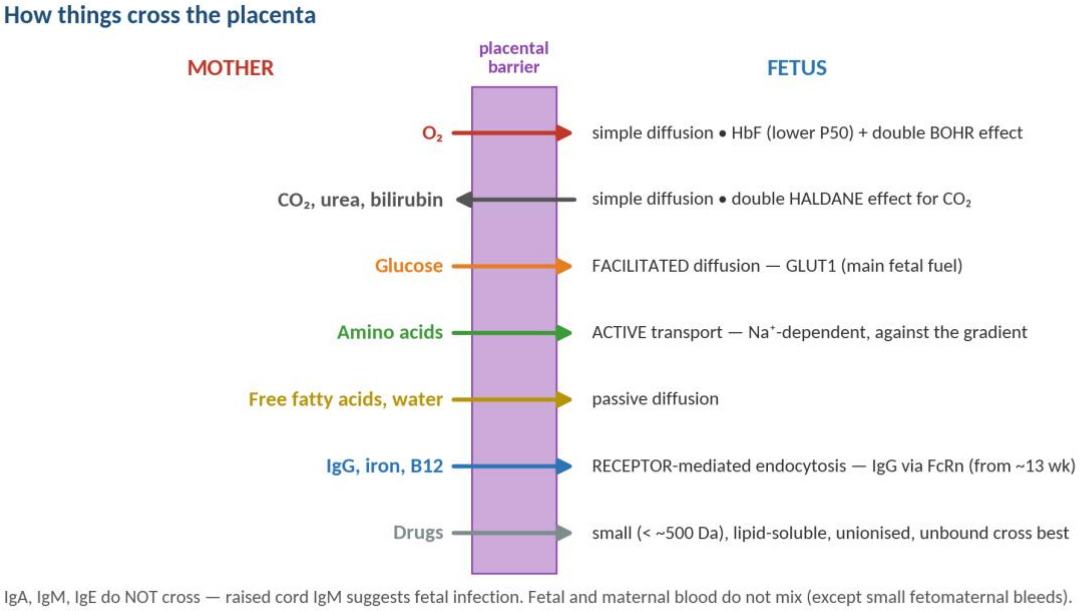


Figure 5. Transfer mechanisms.

Hormone	Source	Role
hCG	Syncytiotrophoblast (Day 7–8)	Rescues the corpus luteum to ~7–9 weeks; pregnancy test; screening marker
Progesterone	Corpus luteum → placenta (~7–9 wk)	Maintains decidua; uterine quiet
Oestriol	Feto-placental unit (fetal adrenal DHEA-S → fetal liver → placenta)	Uterine and breast growth; prostaglandin sensitivity
hPL	Syncytiotrophoblast	Maternal insulin resistance + lipolysis → glucose to the fetus
CRH	Syncytiotrophoblast	Rises through pregnancy — 'placental clock'
Relaxin	Mainly corpus luteum	Ligament softening
Inhibin A / activin	Syncytiotrophoblast	Inhibin A in the quadruple test

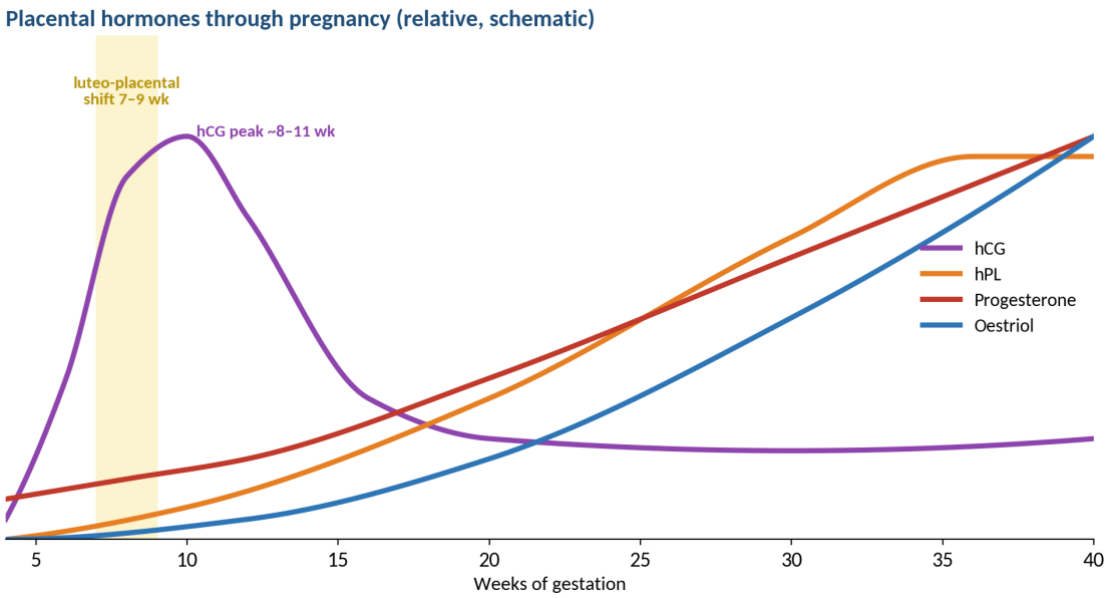


Figure 6. Hormone levels through pregnancy.

- **Immune tolerance**: trophoblast expresses **HLA-G, HLA-E, HLA-C** (not HLA-A/B); **IDO** depletes tryptophan; regulatory T cells expand at the interface.
- **Infections crossing**: Toxoplasma, syphilis, parvovirus B19, VZV, Listeria, rubella, CMV, Zika (HSV, HIV and hepatitis B mostly transmit around delivery).

5 Amniotic Fluid

Feature	Detail
Source	Early: maternal plasma via membranes; from ~16 weeks mainly fetal urine + lung fluid
Volume	~30 mL at 10 weeks → peak ~800 mL–1 L at 34–38 weeks → falls towards term
Turnover	Mainly fetal swallowing and urination
Oligohydramnios	Renal agenesis/obstruction, PPROM, FGR, post-term, NSAIDs/ACE inhibitors
Polyhydramnios	Diabetes, TTTS, oesophageal atresia, anencephaly, neuromuscular (poor swallowing)

6 Clinical Correlates

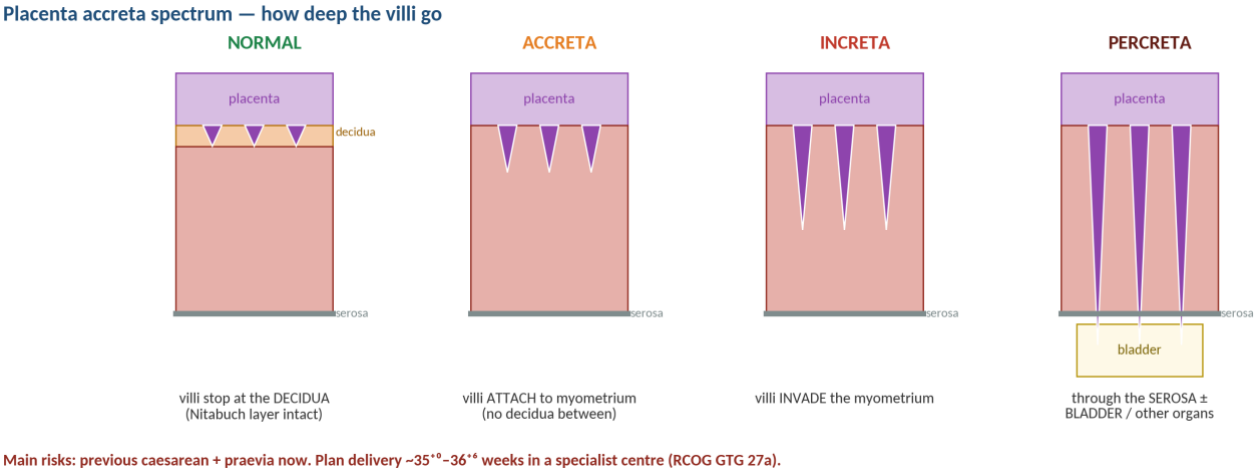


Figure 7. Accreta spectrum.

PLACENTA PRAEVIA (RCOG GTG 27a)

- Over or near the internal os
- Previous caesarean, multiparity, age, smoking, IVF, twins
- **Painless** bleeding
- Confirm with **TVS at 32 weeks**; uncomplicated praevia delivered **36⁺⁰–37⁺⁰**

ABRUPTION

- Separation of a normally sited placenta
- Hypertension, trauma, smoking, cocaine, prior abruption, polyhydramnios
- **Painful** bleeding (may be concealed), tender woody uterus, fetal distress
- DIC, PPH, Sheehan's

VASA PRAEVIA (RCOG GTG 27b)

- Unprotected fetal vessels over the os (often velamentous insertion or succenturiate lobe)
- Rupture of membranes → fetal exsanguination
- Planned caesarean **34⁺⁰–36⁺⁰** weeks

GTD + TWINS

- Moles, invasive mole, choriocarcinoma, PSTT, ETT — register with a UK centre (Charing Cross, Sheffield, Dundee)
- Chorionicity at 11–14 weeks: **lambda** (DC) vs **T** sign (MC)
- MCMA delivered ~32–34 weeks

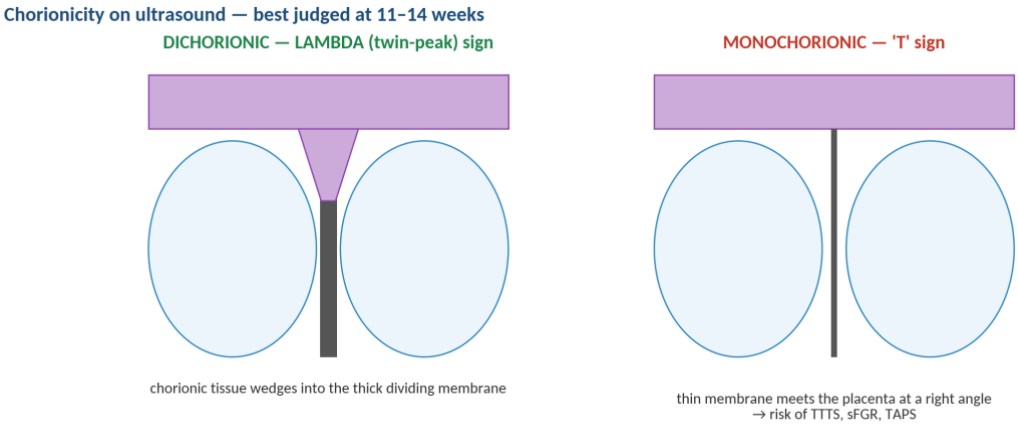


Figure 8. Ultrasound chorionicity signs.

★ PEARL

Pre-eclampsia starts in the placental bed — shallow extravillous trophoblast invasion of the spiral arteries. **Praevia = painless** bleeding; **abruption = painful**. Previous caesarean + praevia now = think **accreta**.

7 MRCOG Exam Pearls — Last-Minute Page

Numbers to know

~500 g Term placenta	**15–20** Cotyledons	**80–100** Spiral arteries	**2–4 µm** Barrier at term
8–10 / 16–18 Remodelling waves (wk)	**~13 wk** IgG transfer begins	**75–150 mg** Aspirin from 12 wk	**36–37 wk** Praevia delivery

HIGH-YIELD CHECKLIST

- ☐ Haemochorial, discoid, ~500 g; villi primary → secondary → tertiary (Days 13, 16, 21).
- ☐ Villous trophoblast (exchange, hormones) vs extravillous (interstitial, endovascular).
- ☐ Spiral arteries remodelled to low-resistance funnels; failure → pre-eclampsia, FGR.
- ☐ sFlt-1/endoglin ↑, PlGF ↓; aspirin 75–150 mg from 12 weeks in high-risk women.
- ☐ Barrier: 4 layers early → thin vasculosyncytial membranes (2–4 µm) at term.
- ☐ O_2 diffusion + HbF + Bohr; glucose GLUT1; amino acids active; IgG via FcRn.
- ☐ hCG, progesterone, oestriol (feto-placental), hPL (insulin resistance), CRH.
- ☐ Amniotic fluid mainly fetal urine after ~16 weeks.
- ☐ Praevia painless; abruption painful; accreta/increta/percreta by depth.
- ☐ Vasa praevia CS 34–36 weeks; lambda vs T sign.

Self-assessment — cover the right-hand column

Question	Answer
What makes a villus 'tertiary'?	Fetal capillaries in its mesoderm core (~Day 21)
Which trophoblast remodels the spiral arteries?	Endovascular extravillous trophoblast
Key angiogenic imbalance in pre-eclampsia?	sFlt-1 (+ soluble endoglin) up, PlGF down
How does glucose cross the placenta?	Facilitated diffusion (GLUT1)
Which antibody crosses, and how?	IgG, via FcRn receptor-mediated transcytosis
Which hormone causes maternal insulin resistance?	hPL (human placental lactogen)
Main source of amniotic fluid after 16 weeks?	Fetal urine
Accreta vs increta vs percreta?	Attached to / into / through the myometrium
Painless bleeding in late pregnancy suggests…?	Placenta praevia
Ultrasound sign of monochorionic twins?	'T' sign

8 References

- Sadler TW. Langman's Medical Embryology. 14th ed. 2019.
- RCOG Green-top Guideline No. 27a. Placenta Praevia and Placenta Accreta: Diagnosis and Management. 2018.
- RCOG Green-top Guideline No. 27b. Vasa Praevia. 2018.
- NICE NG133. Hypertension in pregnancy. 2019 (updated 2023).
- NICE NG137. Twin and triplet pregnancy. 2019.