

First-trimester umbilical cord hemodynamics



Georgia Theodorou¹, Shankeerna Ganeshalingam², Daniel Surbek¹, Sofia Amylidi-Mohr¹, Jarmila Zdanowicz¹, Luigi Raio¹

¹ Inselspital Universitätsspital Bern, Universitätsklinik für Frauenheilkunde, Bern, BE, Switzerland

² Universität Bern, Medizinische Fakultät, Bern, BE, Switzerland

Objectives

- Characterize **umbilical artery (UA) and vein (UV) Doppler flow** at 8–14 weeks
- Assess **gestational-age-related changes**
- Explore the potential **clinical role of first-trimester umbilical Doppler**

Methods

- **150 singleton pregnancies** ➤ Doppler assessment at **8–14 weeks**
- **UA:** positive EDF / AEDF / REDF
- **UV:** pulsatile / continuous
- Free-floating cord loop (**ALARA principles**)

Keywords

Doppler ultrasound · First trimester · Umbilical artery · Placental blood flow

Results

- **UA:** AEDF predominated early ➤ **positive EDF emerged at ~12–13 weeks**
- **UV:** pulsatile early ➤ **continuous flow by ~10–12 weeks**
- **REDF: 2 cases only** ➤ both associated with **fetal pathology** (trisomy 13 / multiple structural abnormalities)

Conclusion

- UA and UV Doppler patterns reflect **early placental development and fetal hemodynamic adaptation**.
- Between 10 and 14 weeks: trophoblastic remodeling of the spiral arteries → **progressive opening and perfusion of the intervillous space**.
- This is accompanied by a transition from **AEDF → positive EDF** in the UA and from **pulsatile → continuous flow** in the UV.
- **UA-REDF should be considered pathological** and warrants prompt investigation.
- **Umbilical Doppler changes are closely related to placental and intervillous development during the first trimester.**

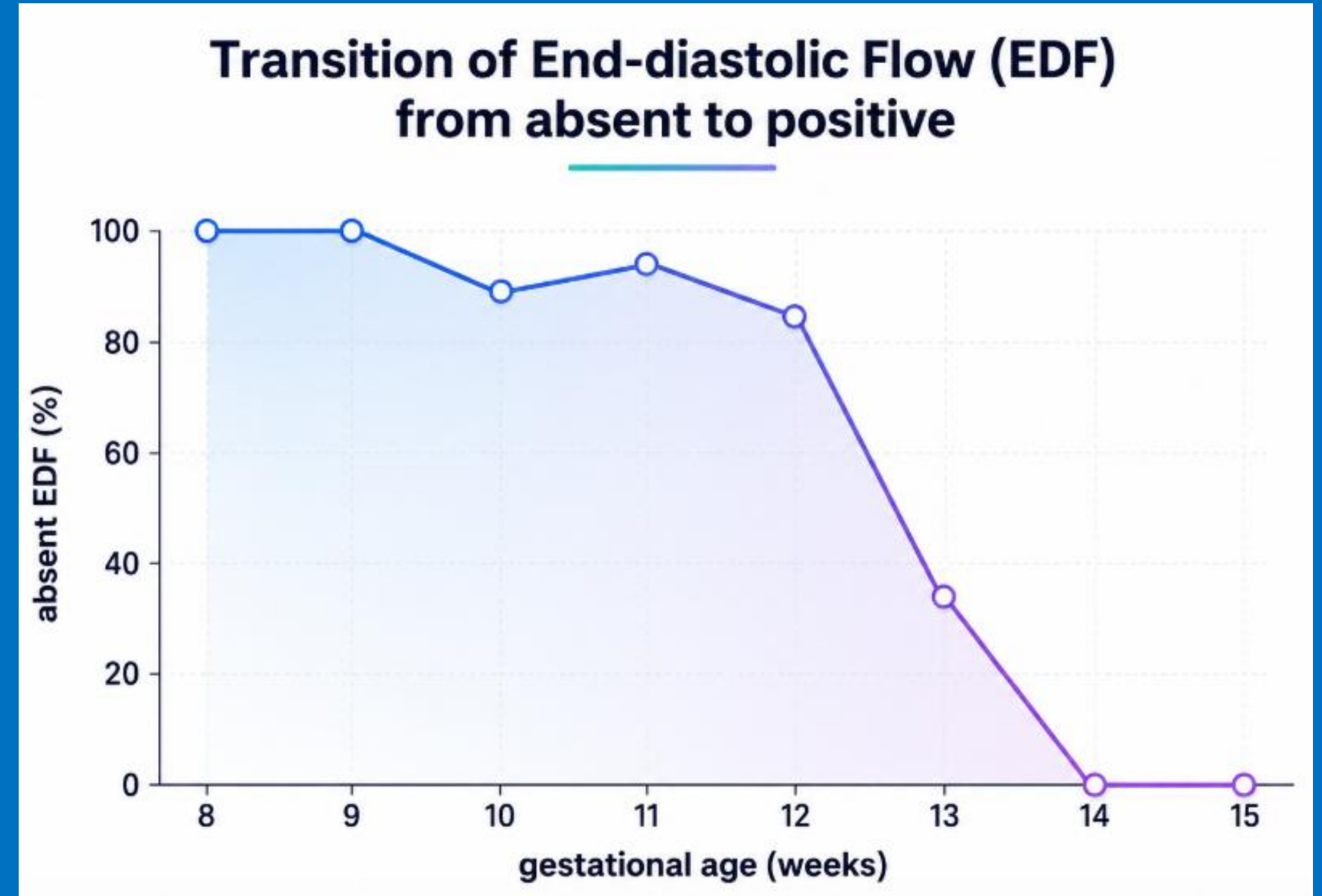


Figure 1. Transition of absent to positive end-diastolic flow (EDF) with advancing gestational age.

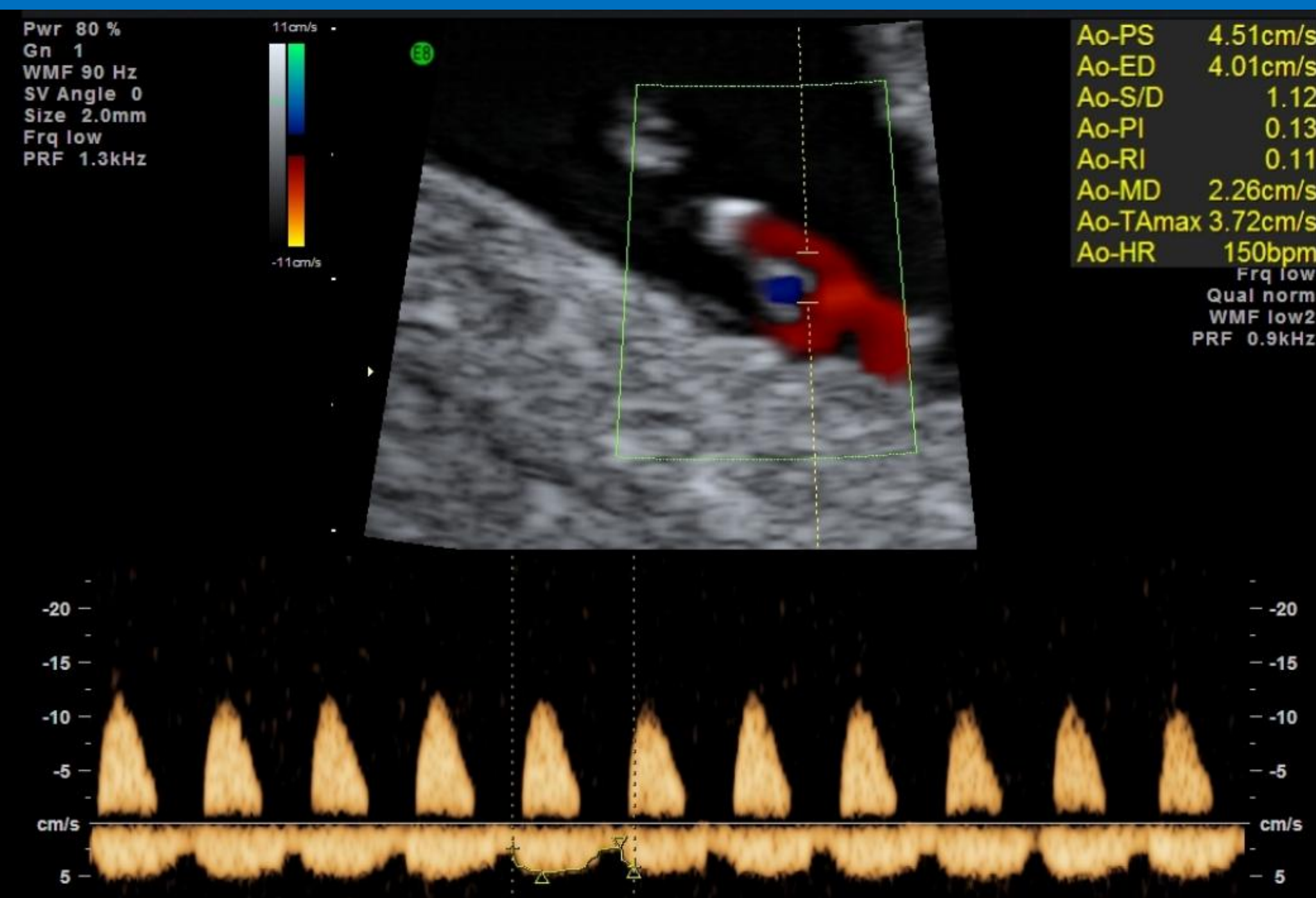


Figure 2. Absent EDF in the umbilical artery and pulsatile umbilical venous flow at 11 weeks + 2 days of gestation.

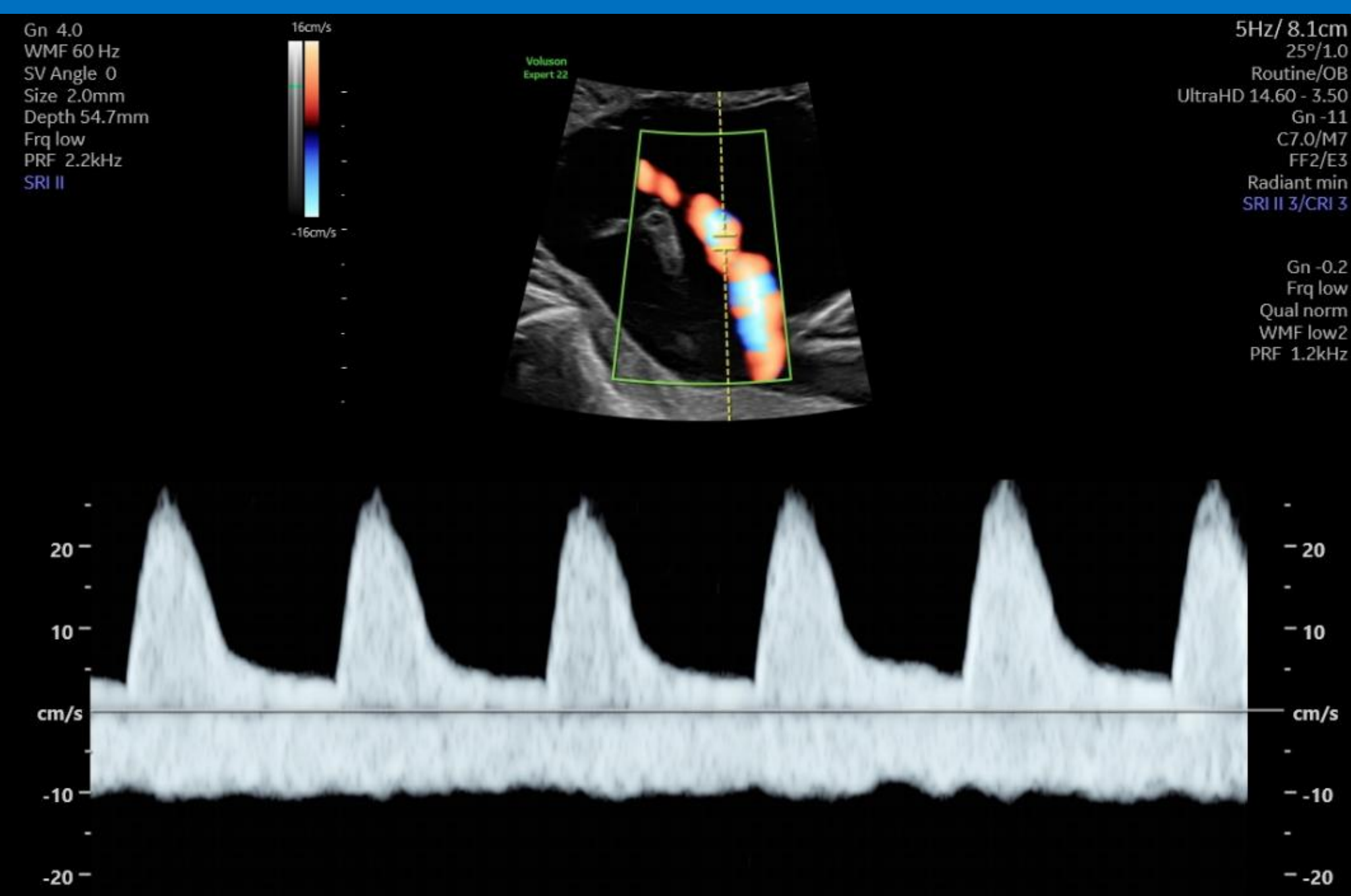


Figure 3. Positive EDF with continuous venous flow at 13 weeks + 6 days of gestation.

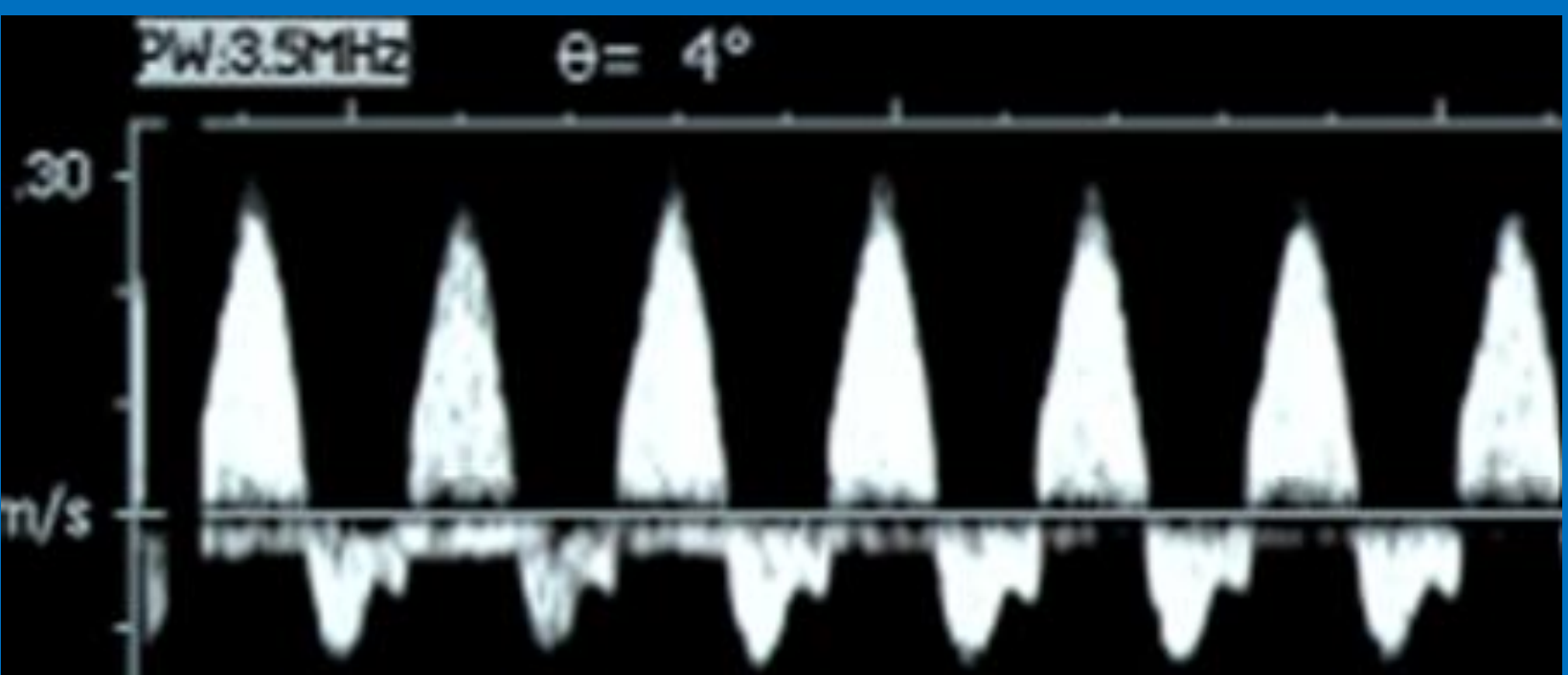


Figure 4. Reversed EDF in a fetus with trisomy 13 at 11 weeks + 5 days of gestation.