Sonographic evaluation of the developing pericallosal circulation at 11-22 weeks’ gestation
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Objective
The purpose of this study was (1) to identify the pericallosal artery and all of its main branching arteries during early gestation from the first trimester onwards, (2) to measure the length of the pericallosal artery during its development and (3) to establish a normal vascular map for each week of development.

Methods
We performed a prospective, longitudinal clinical study in 15 patients, between 11 and 22 weeks of gestation. Gestational age was determined by an early first trimester dating scan. After informed consent, the patients were invited for a (bi)weekly follow-up scan (Voluson E8 Expert, 4-8 MHz abdominal probe) by a single operator up to 22 weeks of pregnancy, the time at which the corpus callosum is considered to be fully developed. In addition to a complete fetal biometry an optimal mid-sagittal view through the anterior fontanel demonstrated the pericallosal artery and its branches by high-definition power color Doppler in accordance with the ALARA principles (settings: HAR-high, SRI II 3, freq mid, WMF low, PRF 0.6 kHz). The origin and the course of the different blood vessels was identified. The length of the pericallosal artery was measured by drawing a straignt line to connect the most anterior and most posterior point. The mean values, the 5th and 95th percentile were calculated for each gestational week. The different courses and the origin of the marginal callosal artery were identified and the distances between the origin of the different branches were measured to develop a vascular map. All patients were examined at a later stage of pregnancy (30-32 weeks) by another operator to verify the presence of a normally developed corpus callosum and pericallosal artery.

Results
15 patients participated in this study, and a total 96 transabdominal ultrasounds scans have been performed, for a mean of 6.4 ultrasound scans per patient. (SD: 1.72) The mean maternal age was 31.2 years (SD: 4.39) and the mean BMI was 24.3 (SD: 3.24). In 8/15 patients the placenta was localized anteriorly. One patient was lost for follow-up. The remaining 14 patients delivered at term. There was no case of abnormal or absent corpus callosum detected in the second trimester of pregnancy nor after birth. The pericallosal artery could be demonstrated in a sagittal plane from a biparietal diameter larger than 20mm. In 3 patients with an ultrasound scan at 11 weeks of gestation the presence of a pericallosal artery could be demonstrated. There was a linear association between gestational age, the BPD and the length of the pericallosal artery. At 12 weeks of pregnancy the pericallosal artery was visualized in all examined fetuses (14/15). The anterior internal frontal artery, the middle internal frontal artery and the posterior internal frontal artery were detected in 93% (13/14), 71% and 28.5% of the cases respectively. All the different branches were visualized from 15 weeks onwards in all cases. The precuneal artery could be detected from 16 weeks onwards (n=7; 58%) and was visualized from 20 weeks in 80% (n=11). In 20% of the cases (n=3), there was a common trunk between the middle and posterior internal frontal artery. Four variations of branching of the calloso-marginal artery (CMA) were observed.

Conclusion
The pericallosal artery and its branches can be identified and measured from 11 weeks onward, and takes its characteristic course. A defective course or an abnormal biometry of the pericallosal artery could be an early sonographic marker for identifying an abnormal development of the corpus callosum.