

CHAPTER 7

EARLY PLACENTATION

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What are the early endometrial changes for embryo implantation and development?

The inner third of the myometrium, as well as the endometrium, is anatomically changed during pregnancy. The most striking change is in the spiral arteries. Extravillous trophoblast attacks these vessels as interstitial cells within the stroma, and as endovascular cells within the vascular lumen. In normal pregnancy, the summed effects are the conversion of these vessels into floppy thin walled arteries, which do not respond to vasoconstrictor stimuli. In human, early changes may be recognized after ovulation and are designated predecidualization. In the uterine stroma adjacent to spiral arteries, fibroblast-like mesenchymal cells differentiate into an epithelioid structure. In addition, they store cytoplasmic glycogen and lipids and secrete new products as components of extracellular matrix (ECM), protease inhibitors, cytokines, hormones, and other peptides. If implantation occurs, they will provide nutrition to the developing conceptus. For development of receptive epithelium and interactions between trophoblast and endometrium, progesterone-dependent differentiation of stromal cells is crucial.

Predecidualization also plays an important role in the decidual uterine natural killer (uNK) cell influx. In human, they are recruited during predecidualization. The decidual uterine natural killer cells contribute to regulation of decidual angiogenesis and spiral arteries remodeling and control extravillous trophoblast invasion. They are less cytotoxic and produce signaling molecules such as cytokines (e.g., tumour necrosis factor alpha (TNF- α) and interleukin, growth factors (e.g., tissue growth factor beta (TGF- β) and placental growth factor (PlGF)), angiogenic factors (e.g., vascular endothelial growth factor (VEGF)), and matrix metalloproteinases (MMPs). They also express surface killer immunoglobulin-like receptors (KIRs), which bind to HLA-C and HLA-G on trophoblast. The KIRs are very highly polymorphic and divide into two main classes, KIR-A (non-activating) and KIR-B (multiply activities). Extravillous trophoblast is directly in contact with endometrial/decidual tissues and does not express the major T-cell ligands, HLA-A or HLA-B.

What is the importance of oxygen as a regulator of villous development?

Oxidative stress inside the placenta plays a role in the pathophysiology of pregnancy disorders, ranging from miscarriage to preeclampsia. During the first trimester, villous trophoblast is well adapted to low oxygen, and it appears that trophoblast is more susceptible to raised oxygen rather than low oxygen. At around week 8 of, the embryonic part of the placenta is already oxygenated by the onset of maternal blood flow. Therefore, villi at this site display increased evidence of oxidative stress, become avascular, and finally regress. This physiological changes result in the formation of the smooth chorion (chorion leave). Maternal blood flow into the embryonic part of the placenta only starts at the transition from the first to the second trimester, at around week 12. Although signs of oxidative stress are obvious within the placenta at this time, the placenta can cope with these oxygen changes. However, if early onset of maternal blood flow occurs in the embryonic part of the placenta, damage to the whole placenta will result. The most severe cases result in missed miscarriages, while less severe cases may continue but may cause pathologies such as pre-eclampsia and IUGR.

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