How does the immune system know what’s what?

Recognizing pregnancy from disease...

What is the role of the immune system in pregnancy?

Interactions between a mother’s immune system and fetal and placental tissue, while not well understood, appear to be critical for successful pregnancy. A balance of activation and suppression of the immune system mediates implantation and fetal growth. Inappropriate immune responses in the mother have been associated with pre-eclampsia and recurrent spontaneous abortion. Based on these findings, it is clear that the immune system plays an important, complex, yet unclear role in pregnancy.

What is the thymus and what does it do?

When a potentially harmful substance or organism enters the body, the immune system breaks it down to small, recognizable pieces called antigens. T cells are a type of immune cell that interact with antigens that are presented to them by other cells. The thymus is the site where T cells mature. While it is good that T cells respond to antigens that do not belong, sometimes T cells can target antigens on cells of our own body. To prevent this self-reactive (or autoimmune) response, the thymus has a critical role in producing a tolerant T cell population. This process is called central tolerance. It is unclear if or how central tolerance influences pregnancy; however, the pregnancy hormone progesterone causes the thymus to dramatically shrink.

How are TRECs used to quantify thymic activity?

T cell receptors (TCR) are signaling molecules on the surface of the T cell that recognize a specific antigen. T cell receptor excision circles (TREC) are excised from DNA after the random rearrangement of gene segments that code for the TCR protein. TRECs are found in cells that have left the thymus but not in cells that are produced by cell division in the circulation. By measuring the amount of TREC in a blood sample, it is possible to estimate the number of T cells leaving the thymus. Quantifying thymic activity can give us an idea of how active the thymus is during a particular state. Since the thymus decreases in size during pregnancy, it is reasonable to expect a decrease in TREC production in the thymus evidenced by a decrease in TREC.

Why do we care about the thymus during pregnancy?

The appropriate immune response is critical to the development of a successful pregnancy. Quantification of TREC in blood samples collected from pregnant women and rhesus macaques may provide evidence that this immune response is conserved across species. Monkeys may serve as a useful model to study immune responses if decreased thymic activity is observed. Conservation of traits in this way indicates evolutionary importance.

The long-term goal is to understand the normal immune response in pregnancy; this may give insight into complications in pregnancy, such as recurrent spontaneous abortion and pre-eclampsia. Understanding the mechanisms that protect the fetus from the immune system may have applications in transplantation medicine. Future scientific endeavors may use knowledge of immune responses during pregnancy to prevent organ and tissue graft rejection in transplant patients.

Further Reading:

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01 July 2019