Hormonal Cascades of Pregnancy: How Drug Delivery Can Regulate Peri and Post-Partum Neurogenesis and Emotional Outcomes among Women

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Numerous factors govern mood changes of pregnancy; like physiological/ biological changes related stress, metabolism changes, or shifting levels of estrogen, progesterone and Oxytocin hormones. Ovarian hormones prepare the maternal body for successful fertilization while placental hormones facilitate maternal adaptations to ensure optimal fetal development and maintain pregnancy; Changes in hormone levels can significantly affect production of neurotransmitters that regulate mood. Every woman responds to these changes differently.

Some experience heightened emotions, while others feel depressed or anxious. It has been generally observed that moodiness flares around 6-10 weeks of pregnancy, eases during second trimester, and reappears as the 'due date' approaches. Prolactin stimulates nursing, Oxytocin is a 'feel good hormone' that stimulates maternal feelings of love and bonding for the baby while sudden variations in 'Progesterone- Estrogen levels' during pregnancy and after delivery have been notoriously linked to depression or anxiety. These hormone cascades are regulated by positive & negative feed-back mechanisms. In 'sudden termination of pregnancy' events as well as 'extended breastfeeding' or 'abruptly ended breast feeding'; maternal adaptations to changed hormone levels are insufficient and extreme outbursts like self-harm and even harming of the baby might occur. The maternal brain is remarkably plastic and shows multifaceted neural changes. Hormone delivery mechanisms can facilitate affective neurogenesis and development of cordial neural networks. Hence, choosing and delivering 'appropriate doses' of 'required hormones' along temporally coordinated mechanisms might positively influence psycho-social and maternal and child health outcomes.

This review highlights peri-partum adult neurogenes and associated mood changes with underlying hormonal mechanisms. It also elucidates the functional consequences of neurogenesis in the peripartum brain and the extent to which this process might play a role in maternal care, cognitive functions and postpartum mood. Finally, the study examines and discusses the effects of hormone dependent maternal neurogenesis on parenting styles.

Background:

Child-bearing hormonal physiology includes complex, intertwined, beneficial processes. One step of hormonal activity anticipates and plans for subsequent phases. Those processes foster healthy pregnancies efficient labor, mother and child health, effective breastfeeding and maximum mother-new-born bonding.

The principal hormones of pregnancy include:

FSH: Follicle-stimulating hormone is the first in a series of hormones needed to start your pregnancy, and is present before you even conceive.

LH: The luteinizing hormone works to orchestrate your menstrual cycle in concert with FSH. Both FSH and LH are itself inactive during pregnancy.

HCG: Once the egg reaches the sperm, human chorionic gonadotropin steps in to enhance estrogen and progesterone output. It also helps your growing baby by suppressing your immune system.

Progesterone: Similarly to estrogen, this pregnancy hormone is first activated by hCG and then the placenta. Progesterone promotes breast tissue growth among its many other purposes, and helps to soften ligaments and cartilage later to prepare you for labor.

Relaxin: This hormone is mostly known for relaxing your muscles, bones, ligaments and joints in preparation for labor later during pregnancy.

Placental growth factor: This hormone supports the increased blood volume needed to nourish your baby by promoting the growth of the blood vessels.

HPL: Human placental lactogen prepares breast-feeding for your breasts. In addition to the placental growth factor, the placenta is created to change the metabolism of your body to feed your infant. In some women it is thought that HPL and placental growth factor block insulin, leading to gestational diabetes.

Oxytocin: This muscle-contracting hormone, though present throughout your pregnancy, is mostly known for stimulating labor contractions.

Prolactin: This hormone increases the size of your breasts, and eventually produces milk.

Although all the hormones for pregnancy are required, a few play an outsize role. HCG gets things going and is what your doctor is testing to confirm your pregnancy in the first place. If it does its job, both estrogen and progesterone play a particularly important role in stimulating fetal development and typical signs of pregnancy during the first and second trimesters.

The discovery in adulthood of continuing neurogenesis has without doubt questioned our understanding of neuronal growth and adult hippocampal function. While our understanding of fate teaching, neuronal maturation and integration is increasing rapidly, a number of key issues remain unanswered. From a cellular and molecular point of view, understanding the in vivo potency of NSCs will be very important, and why neurogenesis occurs only under normal conditions in two restricted areas of the adult brain. In addition, little is known about which signalling pathways are involved in the extension and path-finding of new-born neuronal axonal and dendritic processes.

Peripartum hormones and sensory signs of altering the maternal brain in ways that can lead women to increased anxiety and depression. Inhibitory neurotransmitter GABA and neuropeptide oxytocin (OXT) are the neurochemical systems that underlie these aspects of maternal emotional and mood states.

GABA is the primary inhibitory neurotransmitter in the brain, and there is extensive scientific literature about its involvement in human and other animal anxiety (78,79). GABA acts on at least three distinct transmembrane receptors, an ionotropic GABAA receptor (GABAAR) composed of five of a maximum of 19 receptor subunits, a metabotropic GABAB receptor functioning as hetero- or homodimers consisting of two receptor subunits, and a fairly poorly studied ionotropic GABAC receptor similar to GABAAR in that it is also made of five subunits. GABAARs activity is traditionally considered to be of paramount importance for the modulation of anxiety.

Appropriately balanced adaptations of neurochemical systems regulating peripartum anxiety-like behaviors and depression-like behaviors are essential for overall maternal well-being and care-giving skills, and thus the normal (if not survival) development of their offspring. It is clear from the above review that although adaptations in both the GABA and OXT systems are reasonably well studied for roles in regulating the anxiety and depressive behaviors of peri-partum rodents, there is almost complete lack of knowledge of peripartum changes in women 's central GABA system and their influence on their peripartum anxiety and depression.

As noted above, GABA and OXT interact with the CRH system in some interesting ways. Prolactin is also well known for regulating emotional and caregiving peripartum behaviors and interacting with GABA and OXT both. Thus, dysregulation of the normally finely tuned adaptations of the maternal brain systems GABA, OXT, CRH, and prolactin is likely to underlie the high incidence of emotional and mood disorders during the peripartum period, with adverse effects on maternal care behaviors and offspring development.

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