Prenatal Maternal Stress and Its Consequences for the Fetus

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INTRODUCTION

Maternal HPA axis is involved in the early neuroendocrine programming of the brain fetus. The stressor stimuli action, leads to the activation of this axis which releases to the blood large amounts of the following hormones: CRH, ACTH, cortisol and noradrenaline. If these hormones reaches the fetus during pregnancy, this will cause negative effects at short and long term. If the stressor stimuli persists in a chronic way, the negative feedback over the HPA axis will be altered and so it will be the release of all these hormones.

AIMS

- Determine the role of the cortisol released for the mother and its neuroendocrine effects for the fetus.
- Clarify if the prenatal maternal stress can cause consequences in the fetus in the future.

METHODOLGY

- Literature research on online databases (PubMed and ISI Web of Knowledge).
- Literature research using the references of other articles previously readed.

REGULATION OF HPA AXIS

The HPA axis is regulated by the hypothalamus, the pituitary and the adrenal gland. The hypothalamus secretes CRH which stimulates the release of ACTH from the pituitary gland. ACTH then stimulates the release of cortisol from the adrenal gland.

THE CORTISOL ROLE

- Between the pregnant mother and the fetus there are no neural connections 
  stressor stimuli needs to be transmitted to the fetus somehow:
  1. Stress hormones.
  2. Changes in utero-placentaol blood flow.
  3. Transitory hypoxia periods.

- Cortisol has been proposed as the first hormone to play an important role in the early fetal programming.

- Cortisol plays a major role in the proper regulation of the HPA axis.
- Cortisol in normal concentrations, allows the maturation of fetal organs. When cortisol exceeds critical levels, this causes a broad range of negative effects on the fetus.

REGULATORY MECHANISMS:

- Activation of the hippocampal CA1 and CA3 regions.
- Alterations in the negative feedback of the HPA axis.
- Reduction of GR and MR expression levels.

CORTISOL EFFECTS IN ORGAN MATURATION

- Many fetuses undergoing prenatal stress suffer a decrease in weight.
- No positive correlation between maternal stress and decrease in weight at birth of the animal.
- Female rats injected with DEX* in the last week of pregnancy suffered a decrease in weight.
- Male rats born suffered a decrease in weight.

CONSEQUENCES IN SNC DEVELOPMENT

- Release of ACTH and CRH is controlled by GR and MR. Cortisol exerts an inhibitory effect over these receptors.
- GR and MR are located in: amygdala, hippocampus and pituitary. Also in endometrium, myometrium and ovaries.
- Alterations in the negative feedback of HPA axis.

CONSEQUENCES

- Studies with animal models allowed to demonstrate that environmental factors early in life like exposure to prenatal stress and stress hormones, can cause structural and functional changes that persist throughout the life of the animal. These studies have been the basis for many of the studies that have subsequently been carried out with human fetuses. To date, the most important part of human studies allowed to show that cortisol can influence both in the regulation and understand the neurological basis of prenatal maternal stress and the consequences this entails for the fetus.

REFERENCES