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Paper: IV Group - A
Topic: Parturition and it's Regulation

Parturition and it's Regulation

Parturition is a coordinated process of transition from a quiescent myometrium to an active rhythmically contractile state, requiring complex interplay between placental, fetal, and maternal compartments.

It involves the synchronization of myometrial activity and structural changes of the cervix, leading to regular coordinated uterine contractions, cervical effacement and dilatation and rupture of membranes.

Multiple endocrine, paracrine and autocrine events and overlapping maternal/fetal control mechanisms trigger parturition.

In fact, hormonal, neuroendocrine, inflammatory, and immune mechanisms are involved in the activation of labor. Placenta endocrine function contributes to labor onset and progression. Progesterone withdrawal, increased estrogen bioavailability, corticotrophin releasing hormone (CRH) and neuroendocrine mediators rise, increased prostaglandins, and oxytocin are key events in parturition.

Hormonal Regulation: Parturition

- Regulation of Prostaglandins
- Regulation of Oxytocin

i. Ferguson Reflex

ii. Role of Relaxin

- Role of Oestrodiol Elevation prior to Parturition

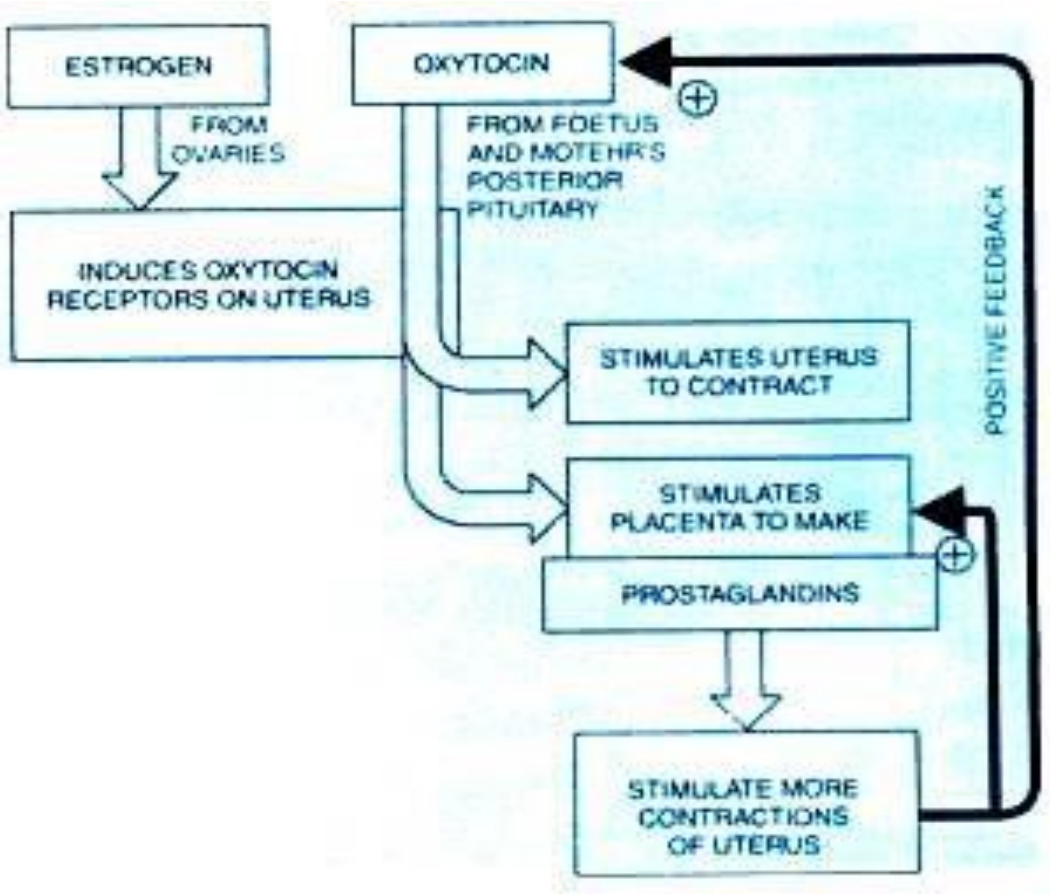

Fig. Hormonal induction of labour

Regulation of Prostaglandins:

The uterus is an important site of prostaglandin synthesis. During pregnancy, the presence of the foetus inhibits the production of prostaglandins in order to prevent luteolysis. At parturition, an increase in prostaglandin synthesis is

required. Prostaglandins are synthesized from arachadonicacid, which is derived from glycerophospholipids by the enzyme phospholipase.

A2 (PLA2). Oestrogen liberates phospholipase A2 from lysosomes. Progesterone stabilizes lysosomes, so phospholipase A2 cannot be liberated from them. An increase in oestrogen: progesterone ratio increases prostaglandin production. The increase in oestradiol (bioactive oestrogen) also increases expression of endometrial oxytocin receptors.

Regulation of Oxytoxin:

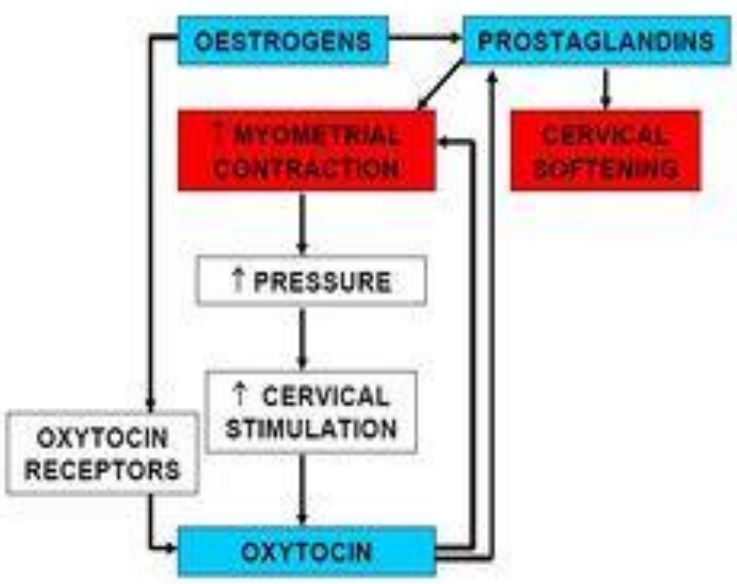

Fig. Regulation of Oxytoxin

Oxytocin acts to increase myometrial contraction (positive feedback) and prostaglandin release.

Ferguson Reflex:

The ferguson reflex is a neuroendocrine reflex. Oxytocin is released in response to cervical stimulation by the foetus, this causes further synthesis and secretion of oxytocin, thus exhibiting positive feedback. Oxytocin concentrations continue to rise until the foetus is expelled, thus the cervical stimulation ceases.

Role of Relaxin:

Relaxin is a glycoprotein hormone. It is produced by either the corpus luteum or placenta depending on species. Its synthesis is stimulated by PGF2α. This causes softening of the connective tissue in the cervix and promotes elasticity of the pelvic ligaments, thus preparing the birth canal so that the passage of the foetus can occur with relative ease.

Role of Oestrodiol Elevation prior to Parturition:

This elevation initiates the secretory activity of the reproductive tract, particularly the cervix, resulting in the cervix and vagina producing mucus. This washes out the cervical seal of pregnancy and lubricates the cervical canal and vagina to reduce friction, enabling the foetus to exit the reproductive tract with relative ease.

Physiology of Parturition:

Parturition constitutes transport of the fetus and its associated membranes from the maternal to the external environment, and represents transition of the fetus to a neonate.

Maturation of the fetal hypothalamic–pituitary–adrenal axis plays an important role in the cascade of neural and endocrine events which lead to parturition in most mammals (Senger, 2003; Evans et al., 2007).

As most clearly demonstrated in ruminants, fetal CRF stimulates the release of ACTH from the fetal pituitary, and ACTH, in turn, stimulates fetal secretion of cortisol by the adrenal glands (Senger, 2003).

Elevations in fetal cortisol (fetal LH may be involved as well) activate placental steroidogenic enzyme systems, resulting in decreased progestagens and elevated estrogens prior to parturition (Ginther, 1992; Evans et al., 2007).

The resulting increase in the estrogen:progestagen ratio facilitates several important processes (e.g., cervical softening, up-regulation of myometrial oxytocin receptors, uterine synthesis of $PGF_{2\alpha}$ and increased blood flow to the gravid uterus and placenta) which prepare the uterus for parturition (Evans et al., 2007).

Normal parturition approaches as neural signals caused by fetal movements and myometrial contractions, along with elevated basal levels of oxytocin and increased secretion of $PGF_{2\alpha}$, bring about the first stage of labour.

A rapid increase in oxytocin and $PGF_{2\alpha}$ secretion leads to rupture of the allantochorionic membrane and the commencement of the second stage of labour. Strong myometrial contractions result in the delivery of offspring, as well as the expulsion of the fetal membranes during the third stage of labour (Senger, 2003; Evans et al., 2007).