The Role of Oxytocin in Physiological Childbirth

Oxytocin, many times referred to as the *love hormone,* is a vital component of a comprehensive neurochemical system that empowers the body to adjust to exceedingly emotional circumstances (Carter & Porges, 2013).

The Physiology of Oxytocin

Oxytocin is a neuroendocrine oligopeptide produced by the magnocellular neurons situated in the supraoptic and paraventricular nuclei of the hypothalamus. Endogenous oxytocin is released in the peripheral circulation from the posterior pituitary and nerve terminals as a reaction to diverse stimuli (Vranchnis et al. 2011). It is also secreted by the corpus luteum, placenta, amnion and decidua. The central and peripheral actions of endogenous oxytocin are executed by its receptors. Apart from the myometrium and mammary gland, expression of oxytocin receptors is also noted in the endometrium, decidua, ovary, testis, epididymis, vas deferens, thymus, heart, kidney and brain. The expression profile shows a tissue-specific as well as a stage-specific pattern (Kimura et al. 2003; Danalache et al. 2010). Since there are a number of variants of the oxytocin receptor, this hormone can have various clinical effects.

Oxytocin is implicated in several physiological and pathological mechanisms and plays a pivotal role in childbirth and lactation (Kim et al. 2017). It is responsible for the initiation, enhancement and frequency of uterine contraction through its effect on uterine smooth muscle (Arrowsmith & Wray, 2014). In labour, oxytocin is released by the fetal posterior pituitary. Conjoint with vasopressin, it is associated with the process of spontaneous labour. It has also been shown to play a crucial role in social bonding. A recent line of evidence has shown that mothers with fluctuant patterns of attachment have lower peripheral oxytocin levels (Samuel et al., 2015). (Figure 1)

A literature review on the role of oxytocin in ameliorating well-being outlined that apart from endocrine and physiological changes, oxytocin is also responsible for the cause and benefits of an overall sense of wellbeing facilitating a synergy of social interactions, serenity, harmony and decreased fear resulting in higher levels of trust. Maintaining a low blood pressure and positive emotional engagement were amid the long-term benefits of oxytocin. On the other hand, lack of oxytocin is linked with an unhealthy state and low quality of life. Social phobias, autism and schizophrenia have all been linked to lack of oxytocin (IsHak, Kahloon & Fakhry, 2011).

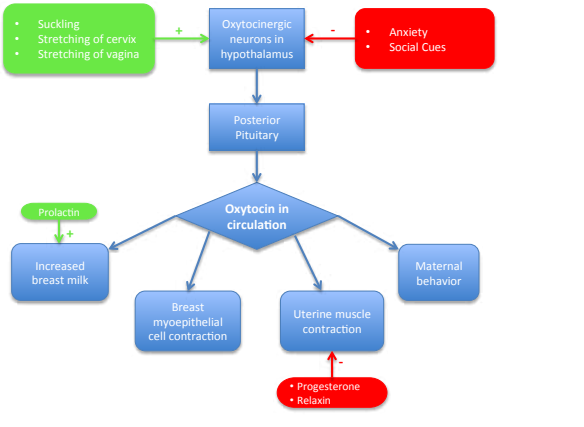

Figure 1: Physiological effects of oxytocin. Adapted from *Quantitative Human Physiology: An Introduction* (p 779), by Feher J.,2012, USA: Elsevier,© 2012 Elsevier Inc.

Oxytocin and Physiological Birth

It has been hypothesised that physiological labour and birth bring into play a healthy form of stress (eustress) on the unborn child. In turn, this creates an epigenomic effect on specific genes especially those responsible for immune responses, weight regulation, and a number of tumour-suppressor genes (Dahlen et al. 2013). Epigenetics refers to the study of heritable changes in gene function that takes place without a change in the DNA sequence. In most cases, these modifications turn genes on or off, permitting or stopping the gene from protein synthesis.

Diminished or increased levels of a number of hormones namely; oxytocin, cortisol and adrenaline generated in labour are likely to result in fetal epigenomic remodelling anomalies which induce effect on abnormal gene expression translational effect (not necessary the gene but the protein) (Dahlen et al. 2013). Non-communicative diseases and bio-behavioural difficulties in the neonatal period and adulthood can be exhibited as a result of this epigenetic remodelling. It has been suggested that the association between the intrauterine environment and the child's health can be epigenetically modulated. This could take place through DNA methylation in the newborn, and implies that physiology of labour and birth may be subject to epigenetic remodelling, especially in the transition from intrauterine to extrauterine life (Monk et al., 2012; Lutz and Turecki, 2014).

Skin to skin following birth

Maternal oxytocin is thought to be released during skin to skin contact following birth. Tactile, olfactory stimulation and exposure to body temperature were all variables implicated in this process (Winberg 2005). Bystrova and colleagues (2009) studied whether different delivery and maternity ward routines effected the mother-infant interaction one year postpartum, delving particularly conditions including skin to skin contact and the newborn being swaddled or dressed in ordinary clothes, in conjunction with or without early suckling. These variables were compared with separation in the delivery ward and during the maternity stay (rooming-in versus nursery care in the maternity ward) to establish their effects on mother-infant interaction one year postpartum using the Parent Child Early Relational Assessment (PCERA). Findings from this study revealed that contact between the mother and the infant in the initial two hours following delivery appeared to be noteworthy for maternal sensitivity, for infant's self-regulation and irritability and for mutuality in the dyad at the time when the infant was 1year old as measured by PCERA. The effect seems to be consequential to the skin-to-skin contact between

mother and infant in the initial 2 hours (early sensitive period). However, early suckling seemed to make up for the absence of skin-to-skin contact.

On a similar note, a systematic review on early skin to skin contact for mothers and their healthy newborn infants, revealed, that babies that were put skin to skin made more physical contact with their mothers and cried less. This also had a positive effect on maternal attachment and babies breastfed for a longer period of time (Moore, Anderson & Bergman, 2007).

Effects of synthetic oxytocin

Synthetic oxytocin (Pitcoin®, Syntocinon®) is routinely used for induction or augmentation of labour (Wood et al. 2014; Reinl et al. 2017). It also plays a crucial role in preventing postpartum haemorrhage (WHO, 2012). It has been documented that although Syntocinon was developed to mimic the effects of endogenous oxytocin, it appears to interrupt the emotional relationship between the mother and the child, bond and lactation and to influence the development of the child (Feldman et al., 2010). Synthetic oxytocin is known to have a wide therapeutic window and its effectiveness differs amid women (Reinl et al. 2017). Risk factors found to be associated with higher oxytocin requirement in labouring women encompassed mother with diabetes, intrapartum fever and fetal macrosomia (Frey et al. 2015). In line with this, Reinl et al. (2017) also identified high body mass index, maternal diabetes and labour induction as risk factors requiring high doses of oxytocin for delivery. Due to unanticipated individual's sensitivity to synthetic oxytocin and prolonged exposure, mothers are more likely to deliver by a caesarean section. Besides, mothers may be at risk of uterine rupture, haemorrhage, hyponatremia, tachsystole, fetal hypoxia, acidemia and abnormal cardiotocography (Simpsom and Knox, 2009).

Conclusion

In conclusion, there is evidence that oxytocin plays an important role in the long term effects on the mother and the infant in connection with physiological childbirth. Effects of oxytocin could encompass changes in both the production and its release as well as its receptor function. These effects may be mediated via the epigenetic changes in the oxytocin system or another mechanisms which have yet to be elucidated.

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