



Effects of skin-to-skin contact and breastfeeding at birth on the incidence of PPH: A physiologically based theory



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ARTICLE INFO

Article history:

Received 7 February 2014

Received in revised form 31 May 2014

Accepted 10 June 2014

Keywords:

Labour, third stage

PPH

Physiology

Oxytocin

Uterus

ABSTRACT

Background: The importance of optimising maternal/baby psychophysiology has been integrated into contemporary midwifery theories but not in the detail required to really understand the underpinning biological basis.

Method: The functioning of the autonomic nervous system, as it relates to the uterus is reviewed. The physiology of myometrial cell contraction and relaxation is outlined. The main focus is on the factors that affect the availability and uptake of oxytocin and adrenaline/noradrenaline in the myometrial cells. These are the two key neuro-hormones, active in the 3rd and 4th stages of labour, that affect uterine contraction and retraction and therefore determine whether the woman will have an atonic PPH or not.

Discussion: The discussion explains and predicts the physiological functioning of the uterus during the 3rd and 4th stages of labour when skin-to-skin contact and breastfeeding occurs and when it does not.

Conclusion: This biologically based theory hypothesises that to achieve and maintain eutony and eulochia, midwives and birthing women should ensure early, prolonged and undisturbed skin-to-skin contact for mother and baby at birth including easy access for spontaneous breastfeeding.

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1. Introduction

This paper presents a physiologically based theory that describes, explains and predicts the mechanisms by which skin-to-skin contact and breastfeeding at birth may reduce the incidence of PPH (key terms are defined in Table 1). The ideas for this theory have their roots in the practice, wide reading and writing of three authors of this paper. The overall focus of this paper is on the neuro-hormonal control of the myometrium, including the regulation of uterine contraction and retraction that is essential to minimise blood loss in the 3rd and 4th stages of labour. First, the background literature concerning the importance of the 3rd and 4th stages of labour is presented. Next, the structure and function of the myometrium is summarised. Then, the functioning of the autonomic nervous system, as it relates to the uterus is described. Attention is then narrowed to the key neuro-hormonal factors, oxytocin and adrenaline/noradrenaline, which interact to affect the functioning of the uterus during the birthing process. The discussion section integrates this knowledge

to explain and predict the physiological functioning of the uterus during 3rd and 4th stage labour both when skin-to-skin contact and breastfeeding occurs, and when they do not.

2. Background

Early mother–infant skin-to-skin contact and breastfeeding is associated with rapid changes to maternal and infant physiology; changes that are known to be important for bonding and breastfeeding.^{1,2} Although there have been great advances in the understanding of reproductive physiology, it remains complex and incompletely understood.^{3–5} What is known is that there is an intricate interplay of multiple neuro-hormonal factors, e.g. prolactin, oxytocin, vasopressin, corticotrophin releasing hormone (CRH) and prostaglandins (pro-contraction), progesterone (pro-relaxation) and cytokines.^{3,6} One recent review⁷ reports on the holistic interactions of the mind, body and behaviour during pregnancy labour and birth. These authors focussed their discussion on labour up to the birth of the baby; they stopped short of examining the reproductive psychophysiology of 3rd and 4th stage labour. An even more recent review² explains how disturbances caused by medicalised interventions disrupt the neuroendocrine mechanisms and thus the initiation of

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Table 1
Definition of key terms.

Term	Definition
Breastfeeding at birth	Any attempt by the baby to suckle the breast within 30 min after the birth. This definition is consistent with the definition in the ObstetriX database and works for the purpose of this review which focuses on oxytocin release and uptake.
Eulochia	The physiological amount of vaginal blood loss during the 3rd and 4th stages of labour that does not cause signs of anaemia or shock. The volume of blood loss varies depending upon the woman's individual health status (new term developed during this study).
Eutony	Maintenance of physiological uterine contractility which prevents excessive bleeding (new term developed during this study).
Corticotrophin releasing hormone (CRH)	CRH plays a fundamental role in orchestrating the General Adaptation Syndrome which is also called the stress response. Released from the anterior pituitary CRH stimulates the release of beta-endorphin and ACTH, which in turn stimulates the release of cortisol, antidiuretic hormone and aldosterone. In addition, during labour CRH stimulates release and enhances effectiveness of prostaglandins and oxytocin. ³
Cortisol	Cortisol is released by the adrenal cortex in response to stress. It spares available glucose for the brain, generates energy from stored reserves and prioritises glucose to those activities needed for survival over lower-priority activities (p. 642–3). ³ Levels of circulating or salivary cortisol act as a marker for stress.
Mammal (Mammalia)	A class of animals characterised by breasts which secrete milk for the nourishment of their young (p. 1268). ³⁷ Placental mammals (including humans) share the same reproductive physiology. ^{24,27}
Postpartum haemorrhage	1. Medical = blood loss greater than 499 mL. ³⁸ 2. Physiological = blood loss of any volume that causes signs of shock or anaemia; the volume varies from woman to woman (new definition developed during this study).
Reproductive psychophysiology	Psychophysiology is a field of science that studies the ways in which the mind and body are mutually interactive. Thus, what a woman is thinking and/or feeling affects the physiological processes associated with her sexual response, pregnancy, labour, birth, breastfeeding and nurturing. ³⁹
Stress	Stress is an organism's total response to environmental stressors (perceived or real). Distress occurs when the stressors exceed the person's bodily or mental ability to adapt. Eustress is an optimal amount of stress to promote successful adaptation and thus resulting in health, growth and happiness. ²³
Skin-to-skin contact at birth	The naked healthy newborn baby is placed prone on the mother's bare abdomen/chest (depending upon cord length) immediately after birth. The baby's head will, ideally, be on the maternal sternum with the woman in an upright or semi-upright position. In this position, the baby has ready access to the maternal nipple and can hear the mother's heart. Both mother and baby should be covered with a warmed blanket and left there undisturbed for at least an hour. The mother and baby are carefully and unobtrusively observed to ensure optimal adaptation of both following birth. This definition is consistent with, but more specific than, previous definitions. ^{40,41}
3rd stage of labour	The period of time extending from the birth of the baby until the delivery of placenta and membranes (p. 531). ¹²
4th stage of labour	The first hour after the delivery of the placenta and membranes (old definition passed down in the oral tradition).
Theory	A theory presents a systematic view of phenomena by specifying the interrelationships between concepts using definitions and propositions with the purpose of explanation and prediction (p. 760). ⁴²

mother–child attachment. This interference, they argue, has life-long negative sequelae for women and babies.

The importance of optimising maternal/baby psychophysiology during labour and birth has been integrated into contemporary theories and models of midwifery care.^{8–10} These theories, however, are not been fully grounded in reproductive psychophysiology. Similarly obstetric and midwifery textbooks have not included key biological knowledge in their discussions of labour and birth. For example four prominent texts are silent on the autonomic nervous system^{11–14} as is Coad and Dunstall's *Anatomy and Physiology for Midwives*¹⁵ and Blackburn's *Maternal Fetal and Neonatal Physiology*.³ This paper makes a contribution to filling the gap as it provides a biologically-based theory about the effects of the autonomic nervous system and oxytocin on mammalian reproductive neurophysiology. We focus on the hypothesis that mother–infant skin-to-skin contact and early breastfeeding in 3rd and 4th stages of labour are integral psychophysiological processes of a 'sensitive period' in parturition² and key to optimal uterine tone. It is plausible that disruptions to these psychophysiological processes are contributing to the increasing rates of postpartum haemorrhage (PPH) in the Western world.^{16,17}

3. The uterus as a muscle

This section considers the muscle cells of the myometrium, which need to contract in a coordinated way to birth the baby and ensure eutony and eulochia. The uterus has three muscle layers; the perimetrium (outer), the myometrium (middle) and the endometrium (inner) layers. The middle layer of the myometrium

is highly vascular; it also has a thick network of spiralling muscle fibres: these fibres act like "living ligatures" to ensure that blood vessels in the uterus are occluded in the 3rd stage of labour, thus preventing postpartum haemorrhage.³

The myometrium is composed of thin and thick syncytial smooth muscle fibre filaments: actin and myosin.¹⁸ The initiation of muscle contraction is an inherent quality of smooth muscle although it is mediated by neurological and hormonal activity. All myometrial cells have the potential to be the pacemaker of the uterus (p. 129).³ In well-coordinated labour contractions, the pacemaker is in the fundus (p. 130).³ Uterine contraction is dependent upon the availability of intracellular calcium which enters the cell after an action potential temporarily changes the permeability of the cell membrane. Calcium binds to myosin and the filaments slide over each other, shortening the cell.³ These filaments are arranged in such a way that intracellular changes generated in one fibre can easily and quickly transfer to the next fibre via gap junctions, (which are areas of low resistance in-between uterine muscle cells).³ Gap junctions are crucial because they allow the uterus to contract in a coordinated way. Control of smooth muscle activation is either mediated electromechanically, as discussed above, or receptor mediated: that is, an agonist binds to a myometrial receptor site on the cell membrane. When oxytocin binds to a myometrial receptor, the ensuing action potential increases intracellular calcium, which causes the muscle cell to contract. Conversely, if adrenaline, a stress hormone, liberated when the sympathetic nervous system (see below) is dominant,¹⁴ binds to the receptor site, calcium is prevented from entering the cell and the muscle relaxes.^{17,18}

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