Mini Review

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Three kinds of caesarean sections: the foetal/neonatal perspective

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Abstract: In the age of hospital births, it is commonplace to contrast the vaginal route and the abdominal route as the basic classification. From the “point of view” of the foetus/neonate, we provide reasons to contrast “birth without labour” (that is birth by pre-labour caesarean section) and all the other vaginal and abdominal modes of birth. From a great diversity of theoretical reasons, one can anticipate that babies born by pre-labour caesarean sections are different from the others. We also provide reasons to popularize the concepts of “in labour non-emergency caesarean sections” and “planned in-labour caesarean sections”.

Keywords: caesarean classification; emergency caesarean; intrapartum caesarean; prelabour caesarean.

Introduction

Today, in the age of hospital births, it is commonplace to contrast the vaginal route and the abdominal route as the basic classification. Until the second half of the twentieth century, in medical circles and among the general public, there were endless discussions about home births vs. hospital births. A resurgence of such discussions is plausible in the future as an effect of the “microbiome revolution” and advances in immunology. In the case of homebirths, the bacteriological environment is familiar and friendly for the neonate, since there is an easy transfer of IgG from the maternal to the foetal bloodstream through the human haemochorial placenta. It is the opposite in the case of a birth “elsewhere”. It is impossible to replicate a home bacteriological environment. It is a crucial issue, since the programming of the immune system is at stake.

There will be reasons to raise questions about the modified prevalence of dysregulations of the immune system among modern human beings (allergic, autoimmune, viral diseases, etc.) in relation to unprecedented bacteriological birth environments.

Pre-labour caesareans

Meanwhile, we must realise that, from the point of view of the foetus/neonate, the focus should be on a more and more frequent way to be born: it is birth by “pre-labour caesarean section”. It must be contrasted with all the other vaginal and abdominal modes of birth. From a great diversity of theoretical reasons, one can anticipate that babies born by pre-labour caesarean sections are different from the others.

First the foetus has not participated in the initiation of labour by emitting signals of lung maturation through the release of specific factors (particularly surfactant) [1, 2]. Furthermore, at a time when it appears that stress hormones have multiple roles to play and when the concept of “stress deprivation” has emerged in scholarly articles, we may look at birth by pre-labour caesarean as a unique, extreme and unprecedented example of stress deprivation. The roles of maternal and fetal stress hormones are well-known. The effects of maternal corticosteroids on fetal lung maturation have practical implications, and labour implies the action of beta-endorphins (releasers of prolactin, which facilitate respiratory functions) [3]. It also implies the release of the main fetal stress hormone (noradrenaline), probably an essential factor participating in lung maturation.

The important point is that the multiple negative effects of stress deprivation among babies born by pre-labour caesareans are usually underestimated. For example, we did not know until recently that, under the effect of noradrenaline, the sense of smell has reached a high degree of maturity at birth among all babies, except those born by pre-labour caesarean. The principle of a Swedish experiment was to expose babies to an odour for 30 min shortly after birth and then to test them for their response to this odour (and also to another odour) at the age of three or four days [4]. Since the concentrations of noradrenaline

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had been evaluated, it was easy to conclude that fetal noradrenaline released during labour is involved in the maturation of the sense of smell. We must emphasize the paramount role of the sense of smell immediately after birth. I had already mentioned in the 1970s that the sense of smell is the main guide towards the nipple as early as during the hour following birth [5, 6]. It has been demonstrated that it is mostly through the sense of smell that the newborn baby can identify its mother (and, to a certain extent, that the mother can identify her baby).

Among other significant studies, we must mention the evaluation of adiponectin concentration – an agent involved in fat metabolism – in cord blood of healthy babies born at term. The concentration is significantly lower after pre-labour caesarean compared with in-labour caesarean or vaginal route [7]. These data suggest a mechanism according to which stress deprivation at birth might be a risk factor for obesity in childhood and adulthood. In the framework of human studies, we must also include evaluations of the concentrations of melatonin in the cord blood. It is low after pre-labour births [8]. This is an important point, since melatonin has protective anti oxidative properties. Furthermore, it confirms that the “darkness hormone” is involved in the birth process. This is one of the reasons why the role of melatonin during labour is topical, at a time when we are learning about a synergy between its uterine receptors and uterine oxytocin receptors.

In general, a baby born after a pre-labour caesarean is physiologically different from the others. For example, babies born pre-labor tend to have a lower body temperature during the first 90 min following birth [9].

Other effects of pre-labour caesareans will probably appear in the near future. It seems that the prevalence of placenta praevia is significantly increased only in the case of a pregnancy following a pre-labour caesarean [10].

All aspects of the period surrounding birth must be considered when analyzing the particularities of “Birth without labour”. There is already an accumulation of data confirming the negative effect of pre-labour caesarean on breastfeeding, particularly at the phase of initiation of lactation [11, 12].

We must also give great importance to data regarding the milk microbiome. There are significant differences between the milk of mothers who gave birth by pre-labour caesarean and those who gave birth by in-labour caesarean or the vaginal route [13]. These data suggest that there are other factors than the operation per se that can alter the process of microbial transmission to milk. Similar differences were found by a Canadian study of the gut flora of four-month-old babies [14]. Joanna Holbrook and her team, in Singapore, suggest interpretations for these surprising

data after collecting fecal samples of babies until the age of 18 months. It appears that, apart from the route of birth and exposure to antibiotics, a shortened duration of pregnancy tends to delay the maturation of the gut flora: one week more or less in the duration of pregnancy is associated with significant differences: a pre-labour caesarean implies the association of all the known factors that can delay the maturation of the gut flora. This study is all the more important since it reveals that a delayed maturation of the gut flora is a risk factor for increased adiposity at the age of 18 months [15].

In spite of possible inter-species differences, we must seriously consider animal experiments suggesting that the stress of labour influences brain development. Such is the case of studies demonstrating that the birth process in mice triggers the expression of a protein (uncoupled protein 2) that is important for the hippocampus development [16]. Let us recall that, among humans, the hippocampus is a major component of the limbic system. It has been compared to an “orchestra conductor” directing brain activity. It has also been presented as a kind of “physiological GPS system”, helping us navigate while also storing memories in space and time: the work of three scientists who studied this important function of the hippocampus has been recognized by the award of the 2014 Nobel Prize in physiology and medicine. This is also the case of studies with rats suggesting that oxytocin-induced uterine contractions reverse the effects of the important neurotransmitter GABA: this primary excitatory neurotransmitter becomes inhibitory [17]. If uterine contractions affect the neurotransmitter systems of rats during an important phase of brain development, why would the same not occur in humans?

We must also take into account that the little known phase of physiological birth preparation is shortened by pre-labour caesareans [18]. According to brain imaging techniques this phase is characterized by reductions in grey matter volume in areas that play a key role in sociability [19]. It is as if the need for privacy is already increasing before the labour starts. We must also give a great importance to the rising rates of melatonin, since its release tends to reduce neocortical activity [20].

Without waiting for a generation of long-term epidemiologic studies, there are already reasons to conclude that a pre-labour caesarean should be a last resource in the framework of obstetrical strategies.

In-labour emergency caesareans

Caesareans performed in real situations of emergency are associated with comparatively bad short-term outcomes.

This well-known fact is easily interpreted. Such caesareans are often performed when there are already signs of fetal distress, after a long period of pharmacological assistance. We must also take into account that emergency caesareans are often performed in a hurry and therefore in poor technical conditions. Furthermore, they are associated with increased risks of negative long-term outcomes. For example, according to an American study, women with a full term second stage caesarean have a spectacular increased rate of subsequent premature births (13.5%) compared with women who had a first stage caesarean (2.3%) and compared to the overall national rate (7–8%) [21].

For obvious reasons, an in-labour emergency caesareans should also be considered a last resource.

In-labour non-emergency caesareans

Until now, the concepts of “in-labour non-emergency caesareans” and “planned in-labour caesareans” have not been introduced in epidemiological studies. They are not identified in the Robson 10-group classification system. In the well-known multicentered randomized controlled trial about breech presentation at term, only two options were considered: planned pre-labour caesarean and planned vaginal route [22].

On the day when the concept of “in-labour non-emergency caesarean” becomes familiar, the doors will be open towards simplified binary strategies, with two basic scenarios: either the birth process is straightforward by the vaginal route, or it appears difficult, and an in-labour caesarean before the stage of emergency appears as the best option. Before such simplified strategies become realistic, the history of midwifery and obstetrics will have to go through several steps. It should be easy to confirm that, as a general rule, babies born by caesarean before the stage of emergency are usually healthy and can easily find the breast soon after birth.

The main step will be to challenge the effects of thousands of years of tradition and cultural conditioning. This is becoming possible in the light of the concept of neocortical inhibition. The key will be to study how some human physiological functions – such as the birth process – are obscured by the activity of a powerful neocortex, and to understand that protection against neocortical stimulants is the solution nature found to adapt to the human particularities.

Finally, we are reaching a phase in the history of midwifery and obstetrical practices when an in-labour

non-emergency caesarean appears in many cases as the best alternative to drugless childbirth. In such a context, we understand the interest for a new generation of tests in order to decide early enough during labour that the vaginal route is acceptable, without waiting for the phase of real emergency.

The birthing pool test is the typical example of a tool adapted to futuristic strategies. It is based on a simple fact. When a woman in hard labour enters the birthing pool and gets immersed in water at the temperature of the body, a spectacular progress in the dilation is supposed to occur within an hour or two. If the already well-advanced dilation remains stable in spite of water immersion, privacy (no camera!) and dim light, one can conclude that there is a major obstacle. There is no reason for procrastinations. It is wiser to perform right away an in-labour non-emergency caesarean.

In the 1970s and early 1980s, I had several opportunities to mention the reason why we originally introduced the concept of birthing pools in the context of a French state hospital. I had also described the most typical scenario: “We tend to reserve the pool for women who are experiencing especially painful contractions (lumbar pain, in particular), and where the dilation of the cervix is not progressing beyond about 5 cm. In these circumstances, there is commonly a strong demand for drugs. In most cases, the cervix becomes fully dilated within 1 or 2 h of immersion ...” [23]. At that time, I could only refer to most cases. Afterwards, I analyzed the outcomes in the rare cases when the dilation had not progressed after an hour or two in the bath. I realized that finally a caesarean had always been necessary, more often than not after long and difficult first and second stages. This is how I started to tacitly take into account what I had not yet called the birthing pool test.

In the near future, it may become relevant to make the classifications of human births still more complex. We are expecting, in particular, a generation of studies evaluating the possible long-term effects on the child of different components of modern pharmacological assistance. What if it appears clearly, for example, that to be born by in-labour non-emergency caesarean section is better, from a long-term perspective, than to be born after several hours of a drip of oxytocin?

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