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Original Article

New approaches for assessing childbirth positions

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ABSTRACT

Background. – An overview of labor based only on epidemiological data cannot identify or explain the mechanisms involved in childbirth. Data about the position that women should take in giving birth are discordant. None of the studies of birth positions adequately define or describe them or their biomechanical impact (pelvic orientation, position of the back). The measurement of the effect of one position relative to that of another requires precise definitions of each position and of their maternal biomechanical consequences, as well as safe measurement methods.
Methodology. – We have developed a system to analyze the position of labor by quantifying the posture of the woman's body parts (including thighs, trunk, and pelvis), using an optoelectronic motion capture device (Vicon™, Oxford Metrics) widely used in human movement analysis and a system for measuring the lumbar curve (Epionics spine system). A specific body model has also been created to conduct this biomechanical analysis, which is based on external markers. With this methodology and model, it should be possible to define: (1) the hip joint angles (flexion/extension, abduction/adduction, internal/external rotation); (2) the ante/retroversion of the pelvis; (3) the lumbar curve.
Discussion. – This methodology could become a reference for assessing delivery postures, one that makes it possible to describe the relation between the postures used in the delivery room and their impact on the pelvis and the spine in an integrated and comprehensive model.
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Background

Although some important issues in obstetrics, such as postpartum hemorrhage, are currently being explored in depth, other are not [1,2]. Among the latter is labor dystocia – the slow or abnormal progression of labor and the most common indication (34%) for primary cesarean delivery, which one large academic hospital in the US reports is increasing at an annual rate of 3.5% [3].

Dystocia is defined as abnormal progression of labor that results from what have been categorized classically as abnormalities of the uterine contractions (that is, of the *power*, as described in some obstetrics books), of the passenger (the fetus: position, size, and presentation), or the passage (pelvis or soft tissues). Any problem of any one of these elements can hamper "the cardinal movements of labor" [4].

Nonetheless, dystocia cannot be understood by analyzing these three elements separately. For instance, the intensity of contractions may decrease over time when labor lasts too long without being the primary cause of this prolongation (a fetal or pelvic anomaly or both can also prolong labor and weaken the intensity of contractions).

Dystocia, whether it occurs in the late first stage of labor (at full dilatation) or during the descent of the fetal head, is classified under the overused term of cephalopelvic disproportion (CPD). Now, for absolute cephalic or pelvic disproportion, there is no safe and acceptable management that leads to vaginal delivery, and it can rarely be diagnosed with certainty. This term originated at a time when the main indication for cesarean delivery was pelvic contracture due to rickets [4]. The rarity of absolute CPD as a diagnosis is confirmed by reports that two thirds or more of women undergoing cesarean delivery for this indication subsequently have vaginal deliveries, often of still larger newborns [5].

Most cases of dystocia therefore do not result from fetus/passage disproportion but rather from inappropriate positioning of the fetus or the passage. Abnormal fetal head position (deflexed

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attitudes of the fetal head, asynclitism, occiput-posterior position) or a poor axis of fetal progression are examples of this inappropriate positioning of the fetus/pelvis that can lead to dystocia and then to a misdiagnosis of CPD. In other words, it is important for the fetus and the pelvis to be in the optimal configuration.

Can "rational obstetrics" produce a new approach to childbirth?

During the active trial of labor, the hard task for the "laborist" is to help the parturient to optimize all the parameters that lead to a vaginal delivery, in particular, the fit between the passage and the passenger [6]. An accurate understanding of the mechanisms involved in labor is thus essential for preventing and treating dystocia. Rosa, Farabeuf, and Gold report that fetal engagement starts best when the approach of the fetal head is at a right angle to the pelvic inlet [7–10]. Fetal progression in the pelvis must ideally follow the pelvic axis, usually called the curve of Carus. This curve bends through 90° from inlet to outlet [11].

The question therefore is how the laborist can help the parturient to have the head at the correct angle and enable progression through the pelvic axis. The literature indicates that the mother's position influences the parameters involved in labor. Acting on the parturient's posture should thus affect the angle between the fetal head and the pelvic inlet.

Daily practice confirms that modification of the parturient's position, often based on empirical knowledge, can enable vaginal delivery without instrumental or cesarean delivery [12,13]. Helping laborists and mothers, in this task, requires further research into the relation between maternal positioning and the angle between the fetus and the pelvic inlet.

It has long been proposed that the position of the legs and thighs and the curvature of the lumbar spine affect obstetrical mechanics. As Aspasia, a midwife and Pericles' partner, pointed out two and a half millennia ago: "If the difficulty comes from the curvature of the lumbar region, he (the physician) will put the parturient in a position with her knees flexed so that, with the vulva situated at the top, the pathways are easier [14]". Later on, Rosa formulated the first principles of postural management of dystocia due to the inadequate angle at which the fetus meets the pelvic inlet [7,8]. According to Rosa, the fetal head approach can be optimized by adequate maternal posture that helps to obtain a sort of "obstetric chute". Rosa proposed that hyperflexion of the thighs helps to produce this favorable maternal posture [8]. Unfortunately, only case reports describe the applications of these principles to dystocia [7,8,12]. Among the potential fields of action for the laborist, flexion of thighs on the trunk, such as the McRoberts' maneuver, affects pelvis orientation and lumbar curve (especially in cases of lordosis) [15].

Despite the evident importance of the positions of the lumbar spine and the pelvis, accurate reports of positions in childbirth and actions or maneuvers affecting posture to promote the course of labor are sparse in the literature. These positions are usually classified simply as vertical or horizontal, as by Atwood et al, with no consideration of the position of the thighs, pelvis, or lumbar spine [16,17]. It is probably because these definitions do not imply real control of the parturient's posture that the current evidence about the effectiveness of various labor or delivery positions in reducing the number of instrumental vaginal or emergency cesarean deliveries remains inconclusive [17–19].

For example, Guttier et al. evaluated the effectiveness of the hands-and-knees (all-fours) position during the first stage of labor to facilitate the rotation of the fetal head to the occiput anterior position [20]. They nonetheless did not consider the precise positions of the thighs, pelvis, or spine during labor, probably because of the difficulty of assessing them. A rigorous and fundamental biomechanical approach is often passed over in favor of including a large cohort of parturients.

An important avenue of research in obstetric biomechanics involves characterizing the influence of the position of the thighs, pelvis, and spine on the angle between the fetus and the pelvic inlet. Such research would improve our understanding of the postural changes that favor labor and would provide insights into the causes of different outcomes for different birthing positions.

Obstetric mechanics: what do we need to know?

The best birthing position is theoretically that which enables the axis of fetal progression to be perpendicular to the superior pelvic inlet and to encounter the fewest obstacles (by flattening of the lumbar dorsal hinge) [8] (Fig. 1). To identify the best birth position, the relations between the lumbar dorsal hinge, the pelvic inlet, and the position of the thighs must be examined in detail. This lumbar-pelvic-femoral complex has been intensively studied in orthopedics, especially in relation to hip prostheses and their effects on pelvic stability and position [21]. Their interrelations have not been adequately explored in obstetrics, however, especially in terms of positions during labor or birth. Definitions of these positions generally only mention the position of the spine relative to the vertical. The position of the pelvis relative to the spine or the flexion of the thighs is rarely even mentioned. Therefore, a scientific and accurate assessment of birth positions must consider the thighs, pelvis, and lumbar curve.

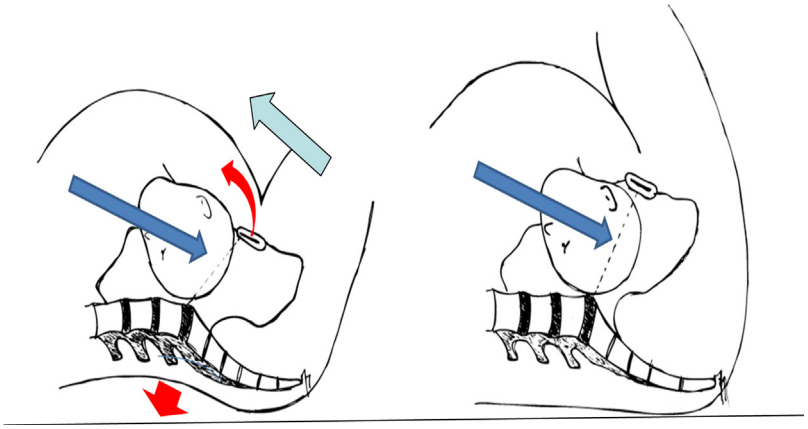

Fig. 1. Impact of hyperflexion on the position of the pelvic inlet and on the dorsal hinge.

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