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Natural Methods to Assist Delivery during the Second Stage of Labour: Part I: Positioning and the Role of Intrapartum Ultrasound

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Abstract

Labour has high importance for every woman's life but also is the moment when many complications might appear increasing significantly morbidity and mortality. Therefore obstetricians have to help women in labour to give birth to their babies naturally, with the highest satisfaction possible. Western standards suggest that women should experience their partirution in the lithotomy or the supine position. However, upright positions have the potential to reduce second stage of labour and to improve neonatal outcomes. Intrapartum ultrasound using different parameters can predict the remaining time to delivery and therefore to make timely interventions in order to decrease instrumental or caesarean deliveries and postpartum hemorrhage as these are the most important complications met in prolonged second stage of labour. In this review the optimal positioning of the women in labour will be presented. Additionally, the ability of intrapartum to shorting second stage duration and to increase maternal satisfaction concerning childbirth will also mentioned.

Introduction

According to WHO, 140 million of births occur annually all around the world.[1] The vast majority of these births are supervene in women without risk factors neither for the women in labour, nor for their babies. Nevertheless, labour is a period of time that carries great importance, as is the time where the morbidity and mortality of both the mother and her unborn baby might increase significantly, if complications appear.

We made an attempt to provide evidence-based information about how the health care providers can assist the woman in labour, in order to help both the mother and her unborn child to experience labour and delivery positively, with the least possible interventions and adverse effects short and long-term. In this, first part of the article, we will present an

overview of the optimal positioning of the women in labour. In addition, intrapartum ultrasound and its role for predicting delivery time, shorting duration of the second stage of labour or increasing maternal satisfaction concerning childbirth will be reviwed. Finally, mother's immediate pospartum connection with the newborn will be also mentioned.

Positioning

Background

The vast majority of women worldwide are positioned in the lithotomy position during the second stage of labour[2] and according to Rossi et al[3] this might be due to cultural norms, as even in nonprescriptive environments women choose giving birth in bed. But when Engelmann observed women in labour back in 1882, stated the opposite: he claimed that if women were not influenced by Western standards, they would prefer changing positions instead of the classic dorsal position[4]. Hodnett and Rooks mentioned that when a woman in parturition is mobilized or changing positions, she has better control of the childbirth procedure, and this might decrease the sense of pain and therefore her need for analgesia[5,6]. Interestingly, Korokawa and Ramond noted that squatting is the most frequently position chosen by women who are free to decide which position they would adopt during labour[7,8]. A significant percentage of obstetricians and midwives agree that when the mother is positioned in bed during labour, makes the provision of care safer, as they can make any intervention such as intavenus fluids, regional anesthesia or the digital vaginal examination, easier, and they also can monitor the fetus's heart rate patterns more efficiently. As a result, health care providers have greater control of the whole procedure. Nevertheless, supine positions during labour has been accused for adverse effects in hemodynamic measures for the mother, infant and newborn,[9,10] and thus, upright positions such as walking, standing, sitting, squatting and kneeling[11] have been recommended as better.

Defining the different position in labour

This is a good opportunity for giving the definitions of the supine positions: *Supine* position is the state where the mother is lying in her back. Supine positions include the *dorsal position* where the woman lies totally on her back, the *lateral position* where the woman is lying on her side, more frequently in the left side in order to eliminate compression to the inferior vena cava resulting free blood flow to the right atrium and therefore better hemodynamic outcomes, the *semi-recumbent position* where the woman is angled partly upright and the *lithotomy position* where the woman's legs are held up in stirrups.

Literature Review

A Cochrane analysis which took place in 2017[12] and both primiparus and multiparus women without epidural analgesia were included, concluded that upright positions can reduce slightly the duration of the second stage of labour (MD, -6.16 minutes; 95% CI -9.74 – 2.59 minutes, P=0.0007) – in this survey the duration of the second stage of labour was identical with the time of pushing, as the women were directed to push immediately after full cervical dilatation. This reduction of second stage duration is mainly due to the group of women who chosen a birth cushion as in this position, the reduction was greater. In addition, the possibility of an instrumental vaginal delivery was also decreased (RR, 0.75; 95% CI, 0.66–0.86) as far as episiotomy rates (RR, 0.75; 95% CI, 0.61– 0.92). The possibility of a caesarean section did not differ between the women who adopted neither a supine nor an upright position (RR 1.22, 95% CI 0.81 to 1.81). Two other maternal outcomes which statistical significance was not presented is the possibility of manual removal of placenta (RR 0.75, 95%CI 0.02- 25.79) and shoulder

dystocia (RR 0.20, 95% CI 0.01- 4.11). As far as the neonatal outcomes are concerned, fetuses whom their mother was having an upright position were less likely to present an abnormal heart rate pattern (RR 0.46, 95% CI 0.22 to 0.93), although the need for admission to a neonatal care unit was not different between the two groups (RR 0.79, 95% CI 0.51 - 1.21). Nevertheless, upright positions were associated with two adverse effects considering the maternal outcomes: estimated blood loss greater than 500 ml, occurred more frequently in women who were positioned uprightly (RR 1.48, 95% CI 1.10 -1.98) and there was also a greater possibility of second degree perineal tears (RR 1.20, 95% CI 1.00 - 1.44). However, there was no clear difference for the possibility of third or fourth grade perineal lacerations (RR 0.72, 95% CI 0.32 - 1.65), or the need for blood transfusion (RR 2.02, 95% CI 0.18 - 22.18).

A different analysis that occurred four years earlier[11], provided evidence that was partly aligned with the Cochrane Analysis above. The major disagreements were that when women was grouped in two arms: the first included women in upright and ambulant positions and the second arm included women in recumbent positions and bed care, the reduction of the second stage of labour was much greater than the 2017 analysis, as the time of pushing was shorter for one hour and 22 minutes (82 minutes- MD -1.36, 95% CI -2.22 - -0.51), and both nuliparus and multiparus women were included to the analysis. The reduction was even greater in the nuliparus sub-group. Other dissents is that in women who were positioned uprightly, caesarean sections was statistical significantly fewer (RR 0.71, 95% CI 0.54 to 0.94), the possibility of epidural analgesia was smaller (RR 0.81, 95% CI 0.66 to 0.99), and their infants were less likely to be transmitted to a neonatal intensive care unit (RR 0.20, 95% CI 0.04 to 0.89).

The effects of epidural analgesia

It is well known that epidural analgesia might increase the total time of labour and therefore the possibility for an operative delivery when vacuum, forceps and caesarean section are included to the definition. Moreover, due to the prolonged labour, newborns are more likely to present low cord pH, low Apgar scores, or increased possibility to be transmitted to an intensive care unit.[13] Pathophysiologically, the increased duration of labour in women with epidural analgesia can be explained because the release of oxytocin might be intervened and being reduced as long as because the mother's bearing down reflex is inhibited[14,15]. In addition, several upright positions which are studied in surveys including women without epidural analgesia, may be difficult to be achieved by women with this type of pain relief. As a result, this group of women has to be studied individually. When women with epidural analgesia were taken into consideration[16], authors couldn't reach a conclusive result because of the low quality of the existing trials including women with epidural analgesia. They found no statistical significant differences between women who were positioned neither in upright nor a supine position concerning many maternal or neonatal outcomes. They had investigated the operative births including instrumental vaginal deliveries and caesarian sections, the duration of the second stage of labour, perineal lacerations requiring suturing, abnormal fetal heart rate patterns where an intervention was needed, low cord pH and admission to neonatal intensive care and they failed to find any statistical significant relation. However, authors suggest position changes during childbirth for women with epidural analgesia, as a sustained position, either upright or supine, is associated with lumbosacral spine and lower extremity nerve injuries. In addition, avoidance of exaggerated flexion of the legs is encouraged, as it might prevent postpartum neurological injuries[17].

2.5. Pathophysiologic Explanation

When women are experiencing parturition uprightly, the pelvis is able to expand as the fetus descents into the birth canal. This downward movement is also assisted by gravity, as in an upright position the heavy and large uterus does not press the major vessels of the mother, leading to unbearable oxygen and nutrition supply to the fetus, improving its acid-base outcomes.[12,18-19] Moreover, in a kneeling or a squatting position, uterine contractions are stronger and more efficient in means of frequency and regularity[11], the fetus takes a better position helping it to pass through the birth canal[20-28], and this occurs, mainly due to both factors discussed above. Interestingly, postural alterations during labour have been associated with better outcomes concerning fetal head malposition or acynclitism[29]. The increased possibility of second degree perineal tears can be explained by this fact: as it is mentioned, an upright position which a significant percentage of women choose is the squatting position. Although, the vast majority of Western women do not have the necessary muscle strength and the balance required to remain squatted for a long period of time, leading to increasing numbers of second degree perineal lacerations[24].

2.6. Maternal Satisfaction

When women are asked to describe their childbirth experience in an upright position, they comment that giving birth uprightly becomes easier and in contrast, when a supine position is chosen, childbirth is described as painful, difficult and uncomfortable. As a result it is recommended by WHO and physicians that every woman should be free to decide the position or mobile state which is ideal for her, wand it carries the less pain and discomfort, and they mention that an upright position can be suggested. Therefore, women would experience parturition better and more positively.[1,11,12]

The role of intrapartum ultrasound

Predicting the remaining time to delivery

The ability of predicting the remaining time to delivery is a major benefit for obstetricians as a prolonged second stage of labour can carry multiple adverse effects for the mother, such as a higher possibility of instrumental vaginal delivery, perineal trauma, postpartum hemorrhage and chorioamnionitis[31-32]. In addition, not only the frequency or duration of the uterine contractions, but also their intensity is equally significant for prognosticating the time to delivery. Thus, several methods had been used as predicting factors for estimating the delivery timing. Firstly, digital vaginal examination has been established as the traditional technique for evaluating cervical dilatation, fetal descent and fetal head rotation, despite the evidence suggesting its limited accuracy and reproducibility[33-34]. Secondly, external tocodynamometry was used for detecting the strength and frequency of the uterine contractions, but its prognostic ability in a situation of an increased maternal body mass index (BMI) is eliminated[35-36]. IntraUterine Pressure Catheter (IUPC) was the third method which was introduced for assessing the efficiency of the uterine contractions[35]. However, IUPC has been blamed for uterine perforation, placental abruption and endometritis[37-43], and it has no impact for any overall maternal or fetal outcome[44-45]. Finally, an innovative technique which is gaining popularity among the obstetric community, is the transperineal ultrasound during the second stage of labour- or transperineal intrapartum ultrasound[33]. This method in non-invasive, with high reproducibility and the progress of the fetal head rotation can be clearly visualized[46].

The usage of intrapartum ultrasound is greatly beneficial, as if the second stage of labour is seems to be prolonged, a timely obstetrician intervention[47] is more than necessary for preventing any of the complication which have been mentioned

above. Morever, a prediction of the delivering time is advantageous when the labour has to accelerate because of a possible abnormal fetal heart rate or a maternal cardiac disease[52].

Additionally, many authors, including Yonetani et al[33] and Ghi et al[52] provided evidence suggesting that intrapartum ultrasound can estimate more accurately and with higher reproducibility the remaining time to delivery, compared to the digital vaginal examination, especially in nulliparous women. This is mainly due to the fact that the intrapartum ultrasound is not affected by the increasing caput succedaneum and deformity of the fetal skull, which are two variables that affects greatly the digital vaginal examination.

Several ultrasound parameters and their capability for predicting the remaining time to delivery have been evaluated and they are presented in Table 1. Nevertheless, many articles in the existing literature argue that the most reliable measure in order to detect more accurately the time to delivery is AoP, which reflects the fetal head descent[50-51]. MLA is the factor that can predict the fetal head rotation. As far as the reproducibility is concerned, MLA and AoP had the highest values among the other ultrasound findings which were studied by Yonetani et al[33], with AoP recording a 0.87 intraclass correlation coefficients and MLA 0.82 for the same observer and 0.75 and 0.27 for two observers, respectively.

Yonetani et al[33] ran a clinical trial assessing the relationship between time to delivery, AoP and MLA in nulliparous and multiparous women. They found that these two ultrasound measures are significantly associated with the remaining time to delivery in both groups. More specifically, the time to delivery is shorten as the AoP is increasing and MLA is decreasing. Speaking with numbers, for nulliparous women a AoP ≥ 160^{o} was significantly (P<0.05) related with the time to delivery, as the 93% of the women with an AoP ≥ 160^{o} delivered within 2 hours. Regarding MLA, nulliparous women with a measure of an MLA < 10^{o} were 92% likely to deliver within 2 hours. For the multiparous women these numbers were for AoP ≥ 150^{o} (92% possibility for delivery within 2 hours) and MLA < 10^{o} (90% possibility for delivery within 2 hours - P<0.05).

Ghi et al[52] in their study, came to an agreement with Yonetani et al and Brocera et al[53] regarding the smaller AoP (P<0.001) and the shorter duration of labour. However, they did not find any relation with MLA. Conversely, they had also investigated PD (P=0.008), which was smaller and HSD (P<0.001), which was greater in early delivery. Early delivery was defined as delivery within 60 minutes starting from the active second stage of labour. Additionally, they assessed these four measures at the beginning of the active second stage (T1) and in 2 40-minute

Table 1. Ultrasound parameters for remaining time to delivery predection.

ULTRASOUND FINDING	DEFINITION
Angle of progression (AoP)	The angle between a line through the long axis of the pubic bone and a line from the anterior edge of the pubis to the leading edge of the fetal head in the maternal midsaggital position[67,69]
ΔAoP	The difference between the AoP measured in a concractile and a non-concractile period69.
Midline Angle (MLA)	The angle between the fetal head midline and the anteroposterior axis of the maternal pelvis in a transverse section[67]
Progression Distance (PD)	The distance between the infrapubic line and the lowest part of the fetal skull[82]
Head-Symphysis Distance (HSD)	The distance between the lowest edge of the symphysis pubis and the nearest point of the fetal skull along the infrapubic line[83]

intervals (T2, T3) until delivery, and they found that these measures were statistically significant only for T1. More specifically, when the HSD is greater than 20mm as soon as the active second stage begins, the possibility of a late delivery is getting higher.

Muramoto et al[35] also reached to similar conclusions in their study which took place in 2016. The AoP was found to be significantly associated with the remaining time to delivery in nulliparous women (139.3 ± 3.8 for ≤50 min vs. 130.2 ± 1.9 for >50 min; P = 0.046), while for multiparous this difference was not statistically significant (135.8 ± 6.2 for ≤20 min vs. 128.5 ± 3.2 for >20 min; P = 0.37). When the AoP was greater than 131°, there is 75% possibility of a spontaneous vaginal delivery within 50 minutes. They had also assessed the difference of the angle of progression during a contraction and the AoP in a non-concractile period (ΔAoP). They found that for nulliparous women, the greater the ΔAoP, the shorter the second stage of labour (52.5 ± 5.0 for ≤50 min vs. 30.9 ± 2.1 for >50 min; P=0.001). In multiparous women, although ΔAoP followed the same trends, it was not statistically significant (43.0 ± 4.3 for ≤20 min vs. 33.5 ± 5.5 for >20 min; P = 0.18). In addition, when ΔAoP was greater than 40°, there was 85% possibility of a spontaneous vaginal delivery within 50 minutes.

Diagnosing a permanent occiput posterior position

In addition, Ghi et al[54] assessed the capability of the intrapartum ultrasound of diagnosing the permanent fetal occiput posterior (OP) position. This knowledge is also greatly beneficial for obstetricians, as fetuses positioned posteriorly have greater possibility for dystocia and other complications (higher possibilities for Caesarean Section and ineffective instrumental vaginal delivery), requiring timely interventions. The authors grouped the fetuses according to their position (anterior *vs* posterior) and they compared their sonographic measures (AoP, HSD, HD, PD and MLA). They found that fetuses with an occiput posterior position presented a significantly smaller AoP (122 ± 17◦ *vs* 138 ± 20◦, *P*=0.016), while HSD (16.5± 5.4mm *vs* 22.8± 6.6 mm, *P*=0.008) and HD were significantly higher (112± 17mm *vs* 86± 19 mm, *P*<0.001) when they were measured at the beginning of the second stage of labour and 40 minutes afterwards. A statistically significant difference was not recorded regarding PD and MLA. A smaller AoP and a greater HSD are presented, because a fetus that is positioned posteriorly follows a downward direction until the forehead has passed the pubic bone, demanding a higher-degree flexion. Conversely, the internal rotation and depth of the posteriorly-positioned fetuses are similar to the anteriorly-positioned ones, leading to similar MLA and PC, respectively.

VISUAL BIOFEEDBACK

Intrapartum ultrasound is not only usefull for predicting the remaining time to delivery or diagnosing an occiput posterior position. Two recent trials (Gilboa et al[54] – 2017 and Belluci et al[46]-2018) suggested that the visualization of the progress of the fetal head using a real-time ultrasound – called otherwise ''visual biofeedback'' has the potential of increasing the efficiency of the bearing down efforts. Biofeedback can be defined as: *the process of getting a deeper understanding of a physiological function of our body, by using methods and instruments which provide information about a specific systemic activity, aiming to gain the ability to improve it*[55].

The first method that was been used in order to improve the efficiency of the bearing down efforts of the parturients, was called ''the mirror technique''[56]. In this method, the woman was placed in front of a mirror and she was able to watch the effects of her pushing efforts on her baby's head revelation. However, when an ultrasound screen is used in order to provide the parturient the information about the fetal

head status, several advantages are presented: firstly, the procedure can take place before the presence of the fetal head in the introtius and secondly, the effort can be translated into a measure of a greater angle of progression.

More specifically, when visual biofeedback via an ultrasound screen, is being used in the labour procedure, it can help parturients with epidural analgesia to push more efficiently, to reduce the possibility of perineal trauma and to feel a stronger connection to the newborn, shortly after delivery. These advantages are mainly due to the potential of the biofeedback of offering to the woman in labour information about her clinical status, the opportunity to change it, and therefore the ability to improve her labour performance. Additionally, the motivation given is considerable increased. Finally, the parturient might feel that she has control of her body and that she has an active role in the whole procedure of delivery.

The visual biofeedback, in order to reveal its positive effects has to be explained to the woman and frequently this illustration is not longer than 5 minutes, it is easy to be understood and its great capability to improve the labour performance makes it cost-effective. The team responsible for the management of the woman's labour, explains briefly on the ultrasound screen the intrapartum ultrasound method and its association of the fetal head and its direction through the birth canal. Afterwards, simple movements which have the ability to move the fetal head, such as cough and the Valsalva effect, are asked to be performed by the mother, in order to understand the movement of her baby's head. Finally, when a uterine contraction is present, the parturient watches the movement of the fetal head towards the birth canal, providing her a clear biofeedback of the efficacy of her bearing down efforts on the ultrasound screen. In addition, the team encouraged the mother to visualize mentally the progress of the fetal head descent until delivery.

The outcomes of Gilboa et al study were really interesting. The pushing efforts improved significantly after the biofeedback intervention (P=0.01), ΔAoP was significantly lower (and this reflects a better fetal descent through the birth canal), the possibility of perineal trauma was reduced by 11.1% and mothers felt a stronger connection to their baby. The non-statistically significant outcomes were the length of the second stage of labour, the maternal feelings of control and satisfaction with childbirth.

Bellussi et al, in contrast with Gilboa et al, found a statistically significant decrease of the active second stage of labour (MD 15 minutes, p=0.01), and this is equivalent with a 20% reduction of the duration of the active second stage. Regarding the AoP, it was greatly increased during the first 20 minutes of coaching (MD: 8,5°, p=0.01).

Conclusion

In conclusion, partirution has significant importance in every woman's life and has to be experienced with the highest satisfaction possible. This can be achieved by offering the woman the opportunity to choose by herself the ideal position in which she will give birth to her child. Additionally, modern literature suggests that intrapartum ultrasound has the potential to reduce the second stage of labour duration and to increase significantly maternal satisfaction and the immediate connection to the newborn. Despite the innovative findings of these trials run since now, they had small samples and their methodology can be improved. Therefore, further research is necessary in order to define the effectiveness of visual biofeedback and thereofre to be established in obstetric daily routine.

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