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REVIEW ARTICLE

Intrapartum Sonographic Assessment of Labor

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Abstract Fetal head progression during labor is difficult to assess. Digital examination has been shown to be an inaccurate method. Utilizing the ultrasound technology in the delivery room can standardize the way we assess head progression. Intrapartum ultrasound is applicable, for the assessment of the progression of labor and assists the obstetrician, in decision making regarding the need for an assisted delivery. This article summarizes the latest studies regarding the usage of ultrasound in the delivery room and the measurements that are used during delivery.

Keywords Intrapartum sonography · Translabial ultrasound

History

There has been a major advancement in fetal assessment during pregnancy, mostly due to the improvement in ultrasound technology. This progress has aided the improvement in the field of fetal anomaly scan especially with the introduction of 3D and 4D technologies and fetal surveillance with the usage of Doppler assessment. While these major steps have changed the way we perceive fetal development, the final stage of the pregnancy—the labor process—has been neglected in this regard until recently. In the major part of the delivery rooms; we still assess the progression of labor digitally. We follow the labor with the same technique used for decades, and we make major decisions based on personal experience without having any reliable objective tool, which can help us make these decisions. This method has many flaws and a large inter observer variation, and thus it is not a very accurate method [1]. Akmal et al. [2] compared vaginal digital examination with ultrasonographic examination of the fetal head position. While the sonographic examination was accurate in all the cases, the digital examination was much less accurate (disagreement in 33.5 % of the cases).

Introduction

During recent years, studies regarding the use of ultrasound for the assessment of labor have emerged. These studies have shown that ultrasound is an effective and accurate tool for the assessment of the station and position of the fetal head during delivery.

Furthermore, various methods have been described to assess the fetal head descent during labor. In the present article, we will briefly review the various ultrasonographic methods which have been described for the assessment of labor progression.

As a prerequisite for performing an intrapartum ultrasound, we need to understand the mechanism of labor. The

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descent of the fetus through the birth canal is composed of seven elements [3].

(1) Engagement of the fetus into the pelvis.
(2) Descent through the canal.
(3) Flexion of the head in order to present the shortest head diameter to the pelvic inlet.
(4) Internal rotation of the head.
(5) Extension until the head is delivered.
(6) External rotation.
(7) Expulsion.

A live birth has been documented recently in a real-time open MRI [4].

Using ultrasound, we can locate the head position [i.e., Occiput anterior (OA), occiput posterior (OP) or occiput transverse position (OT)], and we can describe the exact fetal lie [2].

Blasi et al. [5] have shown in a pilot study that the final head positions in labor can be predicted by following the spine and head position during the second stage of labor. The authors showed that if the fetal back was posterior at the second stage of labor and the fetal head position was OP, the head would probably not rotate to OA position during delivery.

Fetal head advancement is difficult to be imaged by transabdominal ultrasound due to the obscuring effect of the pelvic bones. This obstacle cannot be overcome by the use of transvaginal probe due to its limited imaging depth. These factors have led to the utilization of translabial ultrasound. Translabial ultrasound is performed by placing the probe in a sagittal position on the perineum beneath the pubic bone, thus overcoming this obscuring affect (Fig. 1).

The assessment of the fetal head descent has to be monitored in relation to a constant structure. This structure is the symphysis pubis, which is the reference point between the fetal head and maternal pelvis. Henrich et al. [6] have examined the anatomical relationship between the different structures of the pelvis. This study has shown the relation between the ischial spine (IS) and the inferior pubic line.

The inferior pubic line is located 3 cm caudally to the plane of the IS. This ultrasonographic line is a constant landmark to which we can refer while performing the digital examination for the estimation of head progression.

The main question during labor is the prediction of the feasibility of a normal delivery versus the need for surgical intervention. Several ultrasonographic measurements have emerged as means to assess the progression of labor (Fig. 2) as shown below:

(1) Angle of progression (AoP) is the measurement of the angle between the long axis of the symphysis pubis and the fetal cranium [7, 8]. As the fetal head progresses through the maternal pelvis, the angle increases. Kalache et al. have shown that a mean angle of 174° in the second stage of labor predicted spontaneous vaginal delivery. An angle of 130° predicted vacuum extraction, and an angle of 104° predicted cesarean section [8].
Levy et al. [9] showed that in nonlaboring nulliparous women at term, a narrow angle of less than 95° is associated with a high rate of cesarean delivery.
(2) Head progression distance is the longest vertical distance of the fetal cranium from the infrapubic line [10]. This method was originally described to assess the fetal head engagement. However, this measurement has been evaluated in the second stage of labor and was shown to correlate with the AoP [11].
(3) Head direction is the measurement of the fetal head direction compared to the long axis of the pelvis. An angle >20° increases the probability of a vaginal delivery [11].
(4) Head perineum distance is defined as the shortest distance between the perineum and the bony part of

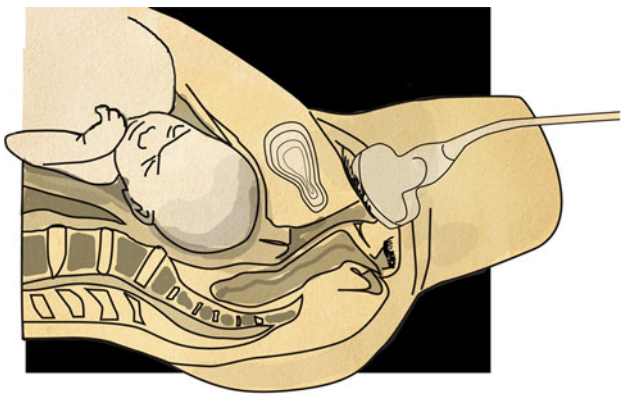

Fig. 1 Translabial ultrasound

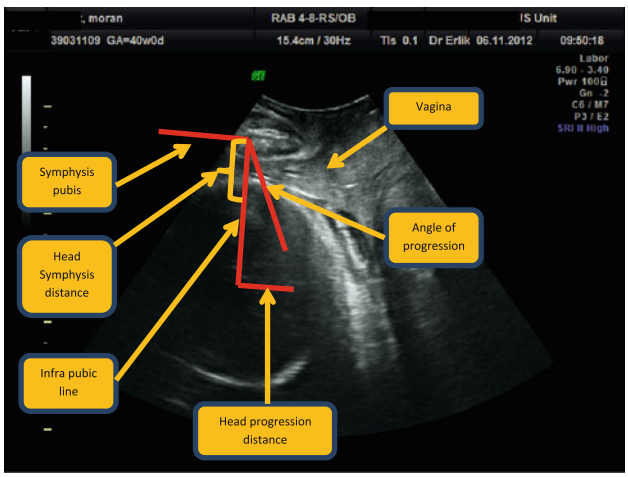

Fig. 2 Mid sagittal transperineal ultrasound measurements

the fetal head. A recent study by Tutschek et al. [12] showed a good correlation with the AoP.

(5) Head symphysis distance is the distance along the infrapubic line form the pubis to the bony part of the fetal head. This is a highly reproducible exam and has been shown to negatively correlate with the AoP [12, 13].

Another promising predictive test for foetal head descent is a newly described dynamic test [11]. The patient is requested to push during the digital examination. The distance between the position of the head during the resting phase and the pushing phase is calculated. According to the authors' experience, this dynamic measurement enables us to assess the feasibility of a mechanically assisted delivery.

Malvasi et al. described an ultrasonographic technique to assess asynclitism, by performing an abdominal axial scan. The fetal skull is visualized in an attempt to demonstrate either the midline of the brain with the two thalami or with the two orbits. When one of the two is demonstrated (midline or both orbits) the lie is correct. If only one thalamus is observed ("the sunset of thalamus and cerebellum") or one orbit ("the squint sign"), we have a sonographic sign for anterior or posterior asynclitism [14].

Gilboa et al. described the measurement of the angle beneath the confluence of the pubic bone. A transperineal axial measurement was performed. Tilting of the transducer by 45° anteriorly to the plane of the symphysis pubis allowed for the demonstration of the two symmetric inferior pubic rami [15].The authors performed a measurement of this angle for women who had had a prolonged second stage. They found that a narrow angle of less than 97° predicted operative delivery Performed, while a wide angle of more than 110° predicted normal deliveries.

Discussion

During the last two decades, the ultrasound examination has become an integral part of the field of obstetrics and gynecology. Nowadays, a gynecological examination is rarely complete without an ultrasound examination, and it is practically unthinkable to follow up a pregnancy without the aid of ultrasound.

We have advanced tremendously in ultrasonographic technology. We routinely use 3D and 4D technologies to evaluate uterine malformations; we perform elaborate Doppler studies in both the fields of obstetrics and gynecology. We routinely screen the fetus from the early stages of pregnancy until term. However, once the patient arrives at the delivery room this wonderful tool is neglected.

Operative intervention due to obstructed labor increases the fetal morbidity and mortality. Towner et al. [16] reviewed the outcome of 583,340 deliveries; they demonstrated an increased risk of intracranial hemorrhage after vacuum and forceps as well as cesarean delivery which were performed during the active phase of labor. Thus, we are constantly searching for a tool that can help us reduce the extent of cesarean sections and mechanically assisted deliveries.

Recent years have witnessed the introduction of ultrasound machines into the delivery room. The ultrasonographic measurements that have been described here are promising. Each of these measurements has its advantages and disadvantages; however, they are all quite easy to master and can be performed using nearly all-portable ultrasound machines. The inter and intraobserver variabilities of these measurements are small and promise an objective way to measure labor progression [11]. It would thus seem that we are equipped with an objective tool that can aid us in the correct management of labor.

Conclusion

As we have shown in this short review, the use of intrapartum ultrasound is applicable, not only for understanding the head lie before applying the vacuum in obstructed second stage but also for assessing the progression of labor and assisting the obstetrician, in decision making regarding the need for an assisted delivery.

We feel that in a few years from now, intrapartum sonography will become an essential tool for the management of labor and will improve our ability to provide good care for our patients.

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