

Intrapartum ultrasonography: prediction of vaginal delivery



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Summary

Intrapartum ultrasound imaging is gaining popularity with increased application due to the relative ease of utilization and direct on-site accessibility. Though initially its use was restricted to esoteric indications and routinely applied antepartum, sonography is now increasingly being used for more mundane intrapartum indications. These may include an illustration of the precise fetal head position, assessment of fetal head engagement and estimation of the fetal weight. Advance evaluation of the complex physiology of childbirth is now possible with intrapartum ultrasonography (including Doppler flow velocimetry). It is still, though not in use for pure clinical management purposes, i. e. development of labor (or the lack of it). Detection of advancing cervical dilatation and descent of the fetal head are two important aspect still out of the scope of intrapartum ultrasound imaging. Determination of the descent of fetal head will be the ultimate challenge of clinical applicability of intrapartum ultrasound imaging. Hopefully, imaging, ultrasound will ultimately permit us to assess these two vital clinical parameters, which have up till now proven indefinable.

Introduction

Intrapartum ultrasound has recently been explored extensively to study the progress of labor and predict the possibility of a vaginal delivery [Tutschek et al., 2011]. Further understanding of the complex physiology of childbirth is possible due to intrapartum ultrasonography. It has been shown to provide objective information on the dynamics of different stages of labor. The

prognosis for operative vaginal delivery can also be assessed by intrapartum ultrasonography [Khalil., 2012].

Avoiding difficult vaginal delivery is the primary focal point of the current obstetric practice. Digital transvaginal examination, on which depends a clinician's ability and still regarded 'gold standard' for obstetric practice has several limitations [Duckelmann et al., 2010]. A fairly new purpose of the ultrasound is developing and the process of gathering knowledge is underway to demonstrate the new role [Akmal et al., 2004]. By merit of its safety and non-invasive nature, given appropriate circumstances, the intrapartum ultrasound examination is applicable for most (if not all) indications currently practiced in the antepartum arena.

Assessment of fetal head station with respect to the narrowest part of the maternal bony pelvis is of essential importance for vaginal delivery to take place. Recent surveys have indicated that ultrasound imaging might allow dynamic and objective quantification of the degree of fetal head descent in the birth canal [Duckelmann and Michaelis., 2010]. Various sonographic modalities have been employed in the intrapartum determination of fetal head engagement [Henrich et al., 2006]. Success in non operative vaginal birth largely depends on the fetal descent and thus it is a central element in the clinical evaluation of progress of labor. Malrotation of the fetal head is much due to the lack of descent, causing relative cephalopelvic disproportion. Clinical assessment of fetal descent is normally carried out by biased and inaccurate digital vaginal assessment regarding the maternal ischial spines [Sherer., 2012]. The presence of molding of fetal head often makes this evaluation more imprecise. In this respect fetal descent

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assessment by intrapartum sonographic is a promising prospect as it may potentially present a better objective evaluation in comparison with digital vaginal assessment [Sherer., 2012].

Ultrasound examination offers valuable information before the beginning of labor, such as placental localization, presence of a neck-cord or Vasa previa, fetal presentation, weight, wellbeing, depiction of prematurity and prolonged pregnancy information. The collateral applicability of ultrasound during labor has also been studied in the literature. For example, assessment before epidural catheter placement [Iliescu et al., 2012]; intrapartum maternal symphyseal separation by transverse suprapubic ultrasound examination [Sherer., 2007]; intrapartum fetal behavior and prediction of adverse perinatal outcome based on amniotic fluid amount or biophysical profile [Tongprasert., 2006]; depiction of the molding and caput succedaneum during, but also before labor [Sherer et al., 1999]; maternal and fetal intrapartum pulsed Doppler blood flow assessment [Szunyogh., 2006]; intrapartum myometrial thickness changes, ultrasound use in the third stage of labor, or the assessment of the postvoid residual volume in laboring and postpartum women with or without epidural analgesia [Iliescu et al., 2006].

Intrapartum ultrasound in labor

Several evidences suggest that clinical evaluation during labor is not always accurate with potential major implications in decision making and prognosis of delivery mode. Different studies suggested that the unorthodox configuration of the maternal pelvis and comparatively large dimensions of the fetal head at term, not all diameters of the latter can necessarily pass

through all diameters of the maternal pelvis. So, vaginal delivery requires the essential adjustment or adaptation of various parts of the fetal head to different segments of the pelvis. Such alterations in place include the engagement, cardinal movements of labor, extension, descent, external rotation, internal rotation, flexion and expulsion [Cunningham, 2001]. Recent reports suggest that intrapartum ultrasound imaging may overcome these problems by application of a series of evaluations for determination of fetal head position and progression during labor thereby offering a better prediction of successful vaginal delivery.

Intrapartum sonography in assessment of fetal head position

Assessment of cervical dilatation, head position and descent of the head is important in labor monitoring. Intrapartum sonographic assessment of fetal head position has been studied since 1989 by Rayburn et al in an experiment with 86 women with labor having an arrest of more than 7 cm cervical dilatation and it was found that ultrasonographic technique improved the diagnosis of fetal head position, and was quite accurate in differentiating between posterior and anterior occipital position. The application of intrapartum ultrasonography in detection of fetal head position has been proven to be more precise than any other clinical transvaginal examination in later decades. Application of intrapartum ultrasonography determined that in most cases, persistent occipitoposterior position resulted from an intrapartum malrotation [Gardberg et al., 1998]. Only 32% of persistent occipitoposterior positioned fetuses showed an absence of rotation from an initial occipitoposterior position recognized at the beginning of labor. Liebermann et al., 2005 made a potential cohort study of 1562 women to assess <https://assignbuster.com/intrapartum-ultrasonography-prediction-of-vaginal-delivery/>

alterations in fetal head position in labor. Sequential ultrasound examinations were done on enrollment, epidural administration and all through advanced labor (> 8cm). It was noted that, of fetuses that were occipitoposterior in advanced labor, at delivery, only 20. 7% were occipitoposterior. Alterations in fetal head position were frequent, and 36% of women had an occipitoposteriorly placed fetus on at least one ultrasound examination. Souka et al., 2003 evaluated the practicability of intrapartum transabdominal ultrasound imaging in determining fetal head position in contrast with transvaginal digitally examined in a longitudinal study of women in the first and second stages of normal or obstructed labor. These authors recognized that assessment of the fetal head position was not possible by digital assessment in 60. 7% (122/201) of cases in the first stage and 30. 8% (41/133) on the second stage of labor. When digital assessment was accessible, the connection with ultrasound assessment was average in the first stage of labor ($\kappa = 0. 59$) and good in the second stage ($\kappa = 0. 77$). Overall, fetal head position assessment by digital examination was accurate in 31. 3% of cases in the first stage and 65. 7% in the second stage [Souka et al., 2003]. They are in the conclusion that intrapartum ultrasound assessment is more accurate than a digital examination of the fetal head position, especially in cases of obstructed labor, which often requires medical intervention. It was also reported that intrapartum ultrasonography raises the accuracy of assessment of fetal head position in active labor [Iliescu et al., 2012]. An examination of 102 patients during active labor showed an overall rate of error (76%) in the clinical determination of fetal head position as whereas intrapartum ultrasound increases the accuracy of fetal head position determination during the second stage of labor. It was reported that <https://assignbuster.com/intrapartum-ultrasonography-prediction-of-vaginal-delivery/>

the accuracy of intrapartum ultrasonography is 92% in the prediction of fetal head positions during spontaneous vaginal delivery [Iliescu et al., 2012]. Adaptation to accommodate different parts of the fetal head to various segments of the pelvis is therefore a significant requirement for vaginal delivery. Such positional changes constitute the cardinal movements of labor, and include engagement, descent, flexion, internal rotation, extension, external rotation and expulsion.

Engagement of fetal head

Various sonographic modalities using transabdominal or translabial USG have been employed in the intrapartum determination of fetal head engagement. An imaginary line representing the pelvic inlet is demarcated by directing the transverse suprapubically positioned transabdominal transducer towards the maternal sacral promontory. Engagement of the fetal head (or the lack thereof) is ascertained according to whether or not the fetal BPD is depicted below or above the pelvic inlet, respectively [Dietz., 2005]. Fetal head engagement in the maternal pelvis pertains to the biparietal diameter (BPD; the maximum transverse diameter of the fetal head) having successfully traversed the anteroposterior diameter of the pelvic inlet [Sherer., 2007].

Fetal head flexion and descent

Both flexion and descent of the fetal head contribute to successful engagement, which may occur during the last weeks of pregnancy or (as recent evidence suggests also among nulliparous patients) only after labor commences. Ultrasound imaging may be utilized with relative ease to depict <https://assignbuster.com/intrapartum-ultrasonography-prediction-of-vaginal-delivery/>

flexion of the fetal head [Murphy et al., 1998]. This may be noted directly while tracking the fetal spine in a sagittal plane towards the fetal head. Of note, various degrees of deflexion or extension of the fetal head at the initiation of labor have been associated with lack of engagement. At times this may reflect various mechanical problems, such as an obstructing leiomyoma of the lower uterine segment or the occurrence of a face presentation (acute hyperextension), which may prevent successful engagement. Varying degrees of deflection of the fetal head may be noted as a result of movement of the depicted BPD from an imaginary line parallel to the pelvic inlet, to any angle up to 90°, the latter representing an acutely hyperextended fetal head-face presentation [Barbera et al., 2009].

Intrapartum ultrasonography in detection of maternal symphysis

The Intrapartum ultrasound examination has been efficiently used for the assessment of the breadth of the maternal symphysis pubis upon engagement of the fetal head and once the major diameter of the fetal head was at the stage of the ischial spines [Björklund., 1997]. It was found that on an average width of the symphysis pubis at the onset of labor was 5.8 mm. Patients with pelvic pain reported average separation of the symphysis pubis during labor to be 0.2 mm during pregnancy. From intrapartum ultrasound it could be concluded that symphyseal separation during labor is minimal regardless of parity or eventual birth weight.

Uterine contractions

An assessment of the fact that whether transvaginal sonography of the cervix before, during or after a uterine contraction in the first stage of labor
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is helpful in prognosis of the path of labor was held out by Saito et al [Saito et al., 2003]. They analyzed and judged the degree of cervical shortening during a contraction in comparison to the cervical length before the contraction, of 39 nulliparous and 34 parous women with uncomplicated singleton, term pregnancies in the first stage of labor. Through a uterine contraction during the normal course of labor, the cervix was shortened by approximately 50% on average. The extent of cervical shortening was notably higher in the normal latent and active phases than in the protracted active phase, prolonged latent phase and in false labor. Nulliparous and parous women showed about the same degree of shortening in the latent and active phases. This study put forward that real-time intrapartum ultrasound examination in early labor might aid in discrimination between inept and normal uterine contractions [Saito et al., 2003].

Examination of third stage labor with intrapartum ultrasound

Ultrasound imaging has enabled further understanding of the physiology of the third stage of labor [Sherer., 2007]. In 1993 Herman et al. evaluated 25 normal deliveries and five with a prolonged third stage of labor [Herman, 1993]. Normal third-stage labor could be split into four phases: the latent form, qualified by a thick, placenta-free wall and thin, placenta-site wall; the contraction stage, with a thickening of the placenta site wall (from <1cm to > 2 cm); the withdrawal phase, when the placenta completes its separation and detaches; and the expulsion phase, which involve a sliding motion of the placenta [Herman., 1993]. Surprisingly, the routinely used uterotonic agents have little say in the findings. The three sonographic phases of separation were: the interval between delivery of the fetus and the beginning of <https://assignbuster.com/intrapartum-ultrasonography-prediction-of-vaginal-delivery/>

placental separation (latent phase), monophasic or multiphasic shearing off of the placenta (detachment phase), and the interval between completing placental separation and vaginal delivery of the placenta (expulsion phase) [Krappet et al., 2000]. In 57 cases with clinically normal placental separation, blood flow between the placenta and myometrium ceased immediately after delivery of the fetus during the latent period. These authors concluded that cessation of blood flow between the basal placenta and myometrium following delivery of the fetus was the sonographic hallmark of normal placental separation. Persistent blood flow demonstrated by color Doppler sonography was suggestive of placenta accrete [Krappet al., 2000].

Application for intrapartum ultrasound examination in clinical management of the third stage of labor has centered mainly upon retained placenta (or fragments thereof) and confirmation of placenta accrete [Sherer, 2007].

Intrapartum ultrasound in evaluating the progression of the fetal head

A number of reports provided intrapartum sonographic data about the progression of the fetal head in an infrapubic approach, aligned in the midsagittal plane, and the contexts of the machine adjusted for widest insonation angle, maximum depth and lowest output frequency, so that the pubic symphysis and fetal skull contour could be visualized almost completely along the screen. Besides the patient in a semirecumbent position with her legs flexed may be tempted to push (push test) to dynamically determine the advance of the fetal head within the birth canal [Iliescu, 2012]. In 2009, Barbera et al presented the measurement of a new parameter of transperineal ultrasound the angle of progression as an

objective, precise and consistent method for measuring the descent of the
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fetal head during labor, after studying 88 term laboring patients with a singleton fetus in cephalic presentation. The same technique was used by Kalache et al., in 2009 on 26 term women with prolonged second stage of labor and occipitoanterior position, which disclosed a substantial kinship between the angle of progression and the indication of cesarean section delivery. The authors establish that the calculated probability of either an easy and successful vacuum extraction or spontaneous vaginal delivery for an angle of progression of 120° was 90%. The Intrapartum ultrasonographic technique is quite effective in prospective analysis of the angle of progression [Kalache et al., 2009], linear measurements and the semi-subjective assessment of head direction during the normal phase of labor [Eggebo, 2008]. Intrapartum ultrasound becomes an important examination in the assessment of fetal head position, and for the decision-making before instrumental vaginal delivery. Both supervision of the labor progress and performing the safe operative delivery can be effectively monitored with the help of ultrasound. In addition it can also be used for effective prediction of whether a vaginal delivery would be successful [Iliescu et al., 2012].

Three dimensional ultrasound

Recently, three-dimensional assessment software designed for labor measurements was developed and all the measurements noted above may be computed based on a single 3D volume scan, stored, superimposed and displayed with previous set of measurements in order to visually appreciate any significant alterations in fetal head progression and rotation during labor. The three measurements, head direction, angle of progression and progression distance, together with the angle from the center crease of the <https://assignbuster.com/intrapartum-ultrasonography-prediction-of-vaginal-delivery/>

school principal to the vertical line of the pelvis have been integrated into 3D software called Sonography-based Volume Computer Aided Display, (SonoVCAD). The aim of SonoVCAD is to supply an objective measure of advance of the fetal brain during labor. Still, on that point are no prospective studies using this instrument to establish which of the measurements are more reliable and accurate in the anticipation of vaginal delivery and in general there is a restriction of these measurements to an anterior position of the fetal occiput [Zimmerman., 2009].

Conclusion

Vaginal birth is a natural process, but occasionally calls for urgent medical intervention to ward off damage to the laboring woman and her unborn child. Intrapartum translabial ultrasound is a simple yet effective technique that improves the understanding of normal and abnormal labor. It makes possible to evaluate and monitor the birth progress and offers a more scientific foundation for assessing labor. Furthermore, the usage of ultrasound is of essential importance in performing a safe operative delivery and can aid in the prediction of whether a vaginal delivery would be successful.