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Ultrasound during labour

Abstract

Digital examination during labour is a subjective and inaccurate method, with high inter-examiners variability. The objective of this study was to evaluate the clinical applicability of ultrasound during labour in order to determine if it can be used as a routine method in labour management. We conducted a literature review for representative articles that studied the use of abdominal and transperineal ultrasound during labour. Intrapartum ultrasound proved to be a reliable technique for labour management and outcome prediction. Abdominal ultrasound is able to precisely determine the position of the fetal spine and head. Transperineal ultrasound can be succesufully used in determining fetal head, perineum distance, angle of progression and cervical dilatation as three markers that could predict labour remaining time and delivery mode.
Keywords: *ultrasound, labour, abdominal, transparietal, intrapartum*

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Introduction

Digital examination has been traditionally used as the standard method to evaluate head position before and during labour, cervical dilatation and fetal head descent, and this left to the appearance of partograms used in most obstetrical clinics[1]. Palpation of the sagittal sutures and fontanels identifies the occiput position in relation to the maternal pelvis and it is considered essential for labour management and determining the need for operative delivery[2,3]. Dystocic position of the fetal head (i.e. occiput posterior and transverse positions) increases the risk of maternal complications such as instrumental vaginal delivery, 3rd and 4th degree perineal lacerations and cesarean delivery[3]. In the same time, neonatal complications are also more frequent, such as meconium-stained amniotic fluid, fetal acidosis, neonatal trauma, Apgar score <7 and high rate of admission to the neonatal intensive care unit[4].

Several studies have shown that digital examination during labour is inaccurate, subjective and unreliable, regardless of examiner experience[5,6]. It has been reported that two doctors differed in cervical dilatation estimations by 2 cm or more on 11% of exams[7].

Identification of pregnant women at risk for cesarean delivery, has the potential to improve pregnancy outcomes and women's satisfaction with their birth experience.

As early as 1977, Lewin used ultrasound to determine the level of the fetal head to the tip of the maternal coccygeal bone[8]. More recently, intrapartum transperineal ultrasound have been described to be useful for monitoring labour progress and fetal head descent in the birth canal in order to predict the delivery mode[9-12]. Transperineal ultrasound is a non-invasive technique that allows direct visualization of the fetal head using a transducer placed between the labia below the pubis symphysis.

Although labour ultrasound was shown to be a useful tool, its clinical value has not yet been defined.

The objective of this study was to evaluate the clinical applicability of ultrasound during labour in order to determine if it can be used as a routine method in labour management.

We searched the literature for representative articles that studied the use of ultrasound during labour. We finally analyzed 8 prospective studies: Blasi[13], Molina[11], Levy[14], Barbera[12], Hassan[15], Eggebø(16), Torkildsen[17], Popowski[18].

Cesarian section

Cesarean section rate has increased dramatically in recent years to approximately 31.1% in the United States of America in 2006[19]. Failure to progress and fetal destress are the two leading cesarean section causes[20]. Cesareans are associated with a high risk of complications and unnecessary cesarean sections should be avoided[21].

Labour assessment has traditionally been done by digital examination of cervical dilatation, fetal presentation, position and descent[1]. Digital assessment of fetal head descent is related to the ischial spines[22], but this method is subjective and inaccurate with high inter-examiners variability[5].

Occiput posterior fetal head position is the most common malposition during labour[13]. Intrapartum ultrasonography is the most accurate tool for assessing the position of the fetal occiput[23]. Blasi and contributors investigated the role of the fetal spine position and of the occiput position during the first and second stages of labour in determining persistent occiput posterior position using intrapartum transabdominal ultrasound[13]. The first stage of labour was defined as regular uterine contractions and cervical dilatation more than 2 cm, and the second stage was defined from full dilatation of the cervix. Intrapartum ultrasound assessed spinal column position and occiput position. Results revealed that when the occiput was posterior and the spine was anterior at the ultrasound none of the infants was born in the occiput posterior position. Blasi et al. noted that when occiput and spine were posterior at the ultrasound only one out of seven babies rotated into an occiput anterior position at birth[13]. Ultrasound determination of fetal head position as a predictive marker on delivery mode was also later certified by the study conducted by Popowski[18].

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Molina and contributors studied the agreement between digital and ultrasound examination of occipital position[11]. They also investigated the ultrasound measurements of head direction, angle of the middle line, progression distance and angle of progression in the second stage of labour in order to determine a reliable ultrasound parameter for assessment of fetal head descent[11]. Digital examination accuracy was evaluated by comparing clinical exam results with transabdominal ultrasound identification of the fetal head position (i.e. by visualizing the fetal orbits, midline cerebral echo and cerebellum or occiput). Head direction was defined as the angle between a line perpendicular to the longer diameter of the pubis starting from the inferior border and another line drawn perpendicular to the widest diameter of the fetal head and was made in plane A. The middle line angle of the head with the vertical was obtained automatically by clicking in plane B on the occipital and frontal points of the fetal head. Progression distance (i.e. the shortest distance between the leading edge of the fetal skull and an imaginary line perpendicular to the pubis from its anterior edge) was obtained automatically by clicking in plane A on the most distal point of the head contour. The angle of progression of the fetal head, defined as the angle between a line through the midline of the pubic bone and a line from the anterior edge of the pubis to the leading edge of fetal head, was also obtained in plane A. Vaginal digital examination identified the correct fetal head position in only 33% of cases, with an angle deviation from the ultrasound result of more than 450 in 66% of cases (i.e. including 14% in which the deviation was more than 900) [11]. This findings confirmed the results of Akmal et al.[23]. Regarding the other ultrasound assessements, the authors concluded that progression angle is the most reproducible parameter for progression of the fetal head in labour.

Fetal head descent in labour was assessed by transperineal ultrasound in a study conducted by Barbera et al.[12]. Head descent was examined by measuring the angle between the long axis of the pubic symphysis and a line extending from its most inferior portion tangentially to the fetal head. Study results revealed that transperineal ultrasound measurement of the angle of head decent is an effective and reproducible tool in assessing labour progression.

Levy and contributors also investigated the progession angle predictive ability of the delivery mode using transperineal ultrasound[14]. Authors assessed if, before onset of labour, parous women have a narrower angle of progression than do nulliparous women and if narrow angle of progression is a good indicator for a higher rate of cesareans. Study concluded that a nulliparous woman at term, outside the labour, with a narrow progression angle (<950) is associated with a high risk of cesarean birth. Regarding parrous women, a narrow angle of progression is not associated with a high rate o cesarean delivery. Authors pointed that parrous women have a narrower angle of progression than do nulliparous women before the onset of the labour.

Cervical dilatation

Assessment of cervical dilatation is an essential step in determining the progress of labour, but digital examination it is highly observer dependent[6] and uncomfortable for the patients[24]. In order to simplify ultrasound examination during labour, Hassan et al. described a two-dimensional transperineal ultrasound technique to measure cervical dilatation in labour[15]. In their technique, the ultrasound transducer was first placed transperineally in sagittal position offering a view of the maternal symphysis pubis, fetal head and upper part of the cervix (i.e. lying just above the upper part of the fetal skull). The transducer was then rotated by 900 in order to obtain a clear view of the cervix, which allowed the measurement of cervical dilatation in an anteroposterior plane. Authors concluded that this technique is easy to be performed using standard ultrasound equipment, requiring a short learning curve being not intrusive for the patients.

Fetal head - perineum distance and angle of progression measured by transperineal ultrasound as predictive factors of labour outcome were assessed in two studies conducted by Eggebø et al.[16] and Torkildsen et al.[17]. Fetal head - perineum distance was measured in a transversal view by placing the transducer in the posterior fourchette as the shortest distance between the outer bony limit of the fetal head and the perineum. Angle of progression was identified in the same way shown by Barbera et al.[12], as the angle between a line through the long axis of the symphysis and the tangent to the fetal head. Eggebø et al.[16] concluded, regarding primiparous women with prolonged first stage of labor, that when fetal head - perineum distance is ≤40 mm or angle of progression is ≥1100 the great majority of women underwent vaginal delivery and when fetal head, perineum distance is >40 mm or angle of progression is <1100 approximately 50% underwent cesarean delivery. Theese results were similar with Torkildsen et al.[17] findings. Both studies showed that angle of progression >1100 and fetal head, perineum distance <40 mm were both good ultrasound predictive parameters of vaginal delivery in prolonged first stage of labor.

Conclusions

Digital pelvic examination for labour assessment is not accurate. Intrapartum ultrasound proved to be a reliable technique for labour management and outcome prediction. Abdominal ultrasound is able to precisely determine the position of the fetal spine and head. Transperineal ultrasound can be succesufully used in determining fetal head, perineum distance, angle of progression and cervical dilatation as three markers that could predict labour remaining time and delivery mode. Fetal head, perineum distance, angle of progression and cervical dilatation may represent important components in conceiving a "sonopartogram" for ultrasound assessment of labour progress. ■

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