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European Journal of Obstetrics & Gynecology and Reproductive Biology 123 (2005) 193–197
EUROPEAN JOURNAL OF OBSTETRICS & GYNECOLOGY AND REPRODUCTIVE BIOLOGY
www.elsevier.com/locate/ejogrb

Fetal head position during the second stage of labor: Comparison of digital vaginal examination and transabdominal ultrasonographic examination

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Received 24 July 2004; received in revised form 14 February 2005; accepted 19 April 2005

Abstract

Objective: To study the correlation between digital vaginal and transabdominal ultrasonographic examination of the fetal head position during the second stage of labor.
Methods: Patients ($n = 110$) carrying a singleton fetus in a vertex position were included. Every patient had ruptured membranes and a fully dilated cervix. Transvaginal examination was randomly performed either by a senior resident or an attending consultant. Immediately afterwards, transabdominal ultrasonography was performed by the same sonographer (OD). Both examiners were blind to each other's results. Sample size was determined by power analysis. Confidence intervals around observed rates were compared using chi-square analysis and Cohen's Kappa test. Logistic regression analysis was performed.
Results: In 70% of cases, both clinical and ultrasound examinations indicated the same position of the fetal head (95% confidence interval, 66–78). Agreement between the two methods reached 80% (95% CI, 71.3–87) when allowing a difference of up to 45° in the head rotation. Logistic regression analysis revealed that gestational age, parity, birth weight, pelvic station and examiner's experience did not significantly affect the accuracy of the examination. Caput succedaneum tended to diminish ($p = 0.09$) the accuracy of clinical examination. The type of fetal head position significantly affected the results. Occiput posterior and transverse head locations were associated with a significantly higher rate of clinical error ($p = 0.001$).
Conclusion: In 20% of the cases, ultrasonographic and clinical results differed significantly (i.e., >45°). This rate reached 50% for occiput posterior and transverse locations. Transabdominal ultrasonography is a simple, quick and efficient way of increasing the accuracy of the assessment of fetal head position during the second stage of labor.

Keywords: Fetal head position; Ultrasonography; Quality control; Safety

1. Introduction

Assessing fetal head location during labor is of paramount importance. Knowledge of the position of the head can help to predict the course of labor. Persistent occiput posterior presentation is associated with higher rates of maternal and neonatal complications [1,2–4]. Thus, knowing the exact position of the fetal head might prevent some of these complications. Furthermore, the exact position of the fetal head must be known for appropriate cephalic forceps application [5].

Clinicians traditionally use palpation of the sagittal suture and of the anterior and posterior fontanels to determine the fetal head position. Nevertheless, clinical examination is highly subjective. Two situations can lead to

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0301-2115/$ – see front matter © 2005 Published by Elsevier Ireland Ltd.
doi:10.1016/j.ejogrb.2005.04.009

misdiagnosis. (1) Large caput succedaneum can mask the fetal sutures and fontanels making it very difficult to identify the head position clinically. (2) Asynclitism can lead to an asymmetric location of the classical anatomical landmarks (i.e., fontanels and sutures) and increase the difficulty of the diagnosis. If unrecognized, these situations are potentially dangerous. Indeed, in cases of forceps application, such errors can lead to eye or brachial plexus trauma [6,7].

Recent studies suggest that ultrasound assessment during labor can help to assess the fetal head position correctly [8–11]. Nevertheless, only two studies have specifically commented upon the correlation between clinical and ultrasound examination according to head position [9,10]. The aim of our study was to assess the correlation between these two examinations in occiput anterior and occiput posterior or transverse positions.

2. Patients and methods

This prospective, randomized study included patients that delivered in a teaching maternity hospital between May and December 2003. Informed consent was obtained from every participant.

Fully dilated women with cephalic-presenting fetuses were included. All patients had ruptured membranes. Eligible patients were randomly assigned to either the ''senior resident'' group (digital vaginal examination performed by the senior resident) or the ''attending physician'' group (digital vaginal examination performed by the attending physician) in a ratio of 1:1 by means of computer-generated random numbers. Randomization was performed using blocks of four and opaque sealed envelopes.

Operators were free to use their own clinical criteria to identify the fetal head position. The level of the descent of the presenting part in the birth canal was determined accordingly to the 1988 ACOG classification in 11 levels (−5 to +5), and the presence of caput succedaneum was recorded. Head position was classified as one of the following eight categories: occiput anterior (OA; 0°), left occiput anterior (LOA; i.e., 45°), left occiput transverse (LOT; i.e., 90°), left occiput posterior (LOP; i.e., 135°), occiput posterior (OP; i.e., 180°), right occiput posterior (ROP; i.e., 225°), right occiput transverse (ROT; i.e., 270°), right occiput anterior (ROA; i.e., 315°). In cases that did not exactly match one of those eight locations the clinician was asked to give the nearest location.

Immediately after the clinical examination was performed, the fetal head position was determined sonographically by the same sonographer (OD) who was unaware of the clinical findings. The ultrasonographic examination was performed using a Hitachi EUB-415-CFM machine with a 3.5 MHz abdominal probe. All examinations were performed in the supine position. We routinely used an ''ultrasound algorithm'' to locate the fetal head. This algorithm uses the fetal orbital region and the fetal cervical spine to locate the head 12 and takes into account the fact that less than 20% of deliveries occur in a persistent occiput posterior position [2–4,12–15]. The ultrasound transducer was placed longitudinally, tangentially to the skin and used to look for the cervical fetal spine and occipital bone. In cases of OA, LOA and ROA, the cervical spine and occipital bone appears, respectively, on the midline of the maternal abdomen, half way between the left anterosuperior iliac spine and the pubis, and half way between the right anterosuperior iliac spine and the pubis. If the fetal cervical spine and occipital bone could not be found at one of these three locations, the sonographer looked for an ROT or LOT location. In such cases, the cervical spine is located at the level of the right or left anterosuperior iliac spine. The transducer was placed transversely in the suprapubic region of the maternal abdomen and the fetal head position was confirmed using the position of the midline cerebral echo and that of the cerebellum [10,16]. Finally, the sonographer looked for a posterior head location (OP, LOP, ROP). In case of OP, fetal orbits are symmetrically located on each side of the maternal pubic bone. In case of ROP, the orbits are located on the left side, and in case of LOP, orbits are located on the right side. The location was then confirmed using the method already described [10,16].

Power analyses were performed with a pre-requisite of a 95% confidence interval (CI) around an estimated fraction of error of no more than ±10%. This indicated that 100 subjects were required. We assumed that attending consultants were three times more likely than senior residents to determine the correct head position by transvaginal digital examination. With an alpha value of 0.05 and a power of 80%, at least 49 subjects were required in each group.

Confidence intervals around all observed rates and proportions were compared using chi-square analysis. Cohen's Kappa test of concordance was used to assess the relationship between clinical transvaginal and ultrasonographical abdominal examinations.

Multivariate regression analysis was performed to identify variables that could predict a risk of error higher than a 45° arc. $p < 0.05$ was considered statistically significant.

Statistical tests were carried out using Excel 1998 (Microsoft Office 1998, Microsoft corporation, Redmont, WA, USA) and SPSS statistical package (version 11.5, SPSS Inc., Chicago, IL, USA).

3. Results

One hundred and ten patients were included. Mean maternal age was 30.7 ± 5.3 years, 62% ($n = 68$) were nulliparous, mean gestational age was 39.8 ± 1.2 weeks, and mean birth weight was 3420 ± 471 g. All women had epidural analgesia. Characteristics of the 110 patients are given in Table 1.

Digital vaginal examinations were performed by senior residents in 50% ($n = 55$) of cases and by attending