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Comparison of transvaginal digital examination with intrapartum sonography to determine fetal head position before instrumental delivery

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KEYWORDS: fetal position; instrumental delivery; ultrasound

ABSTRACT

Objective *To investigate the accuracy of intrapartum transvaginal digital examination in defining the position of the fetal head before instrumental delivery.*

Patients and Methods *In 64 singleton pregnancies undergoing instrumental delivery the fetal head position was determined by transvaginal digital examination by the attending obstetrician. Immediately after or before the clinical examination, the fetal head position was determined by transabdominal ultrasound by a trained sonographer who was not aware of the clinical findings. The digital examination was considered to be correct if the fetal head position was within ± 45° of the ultrasound finding. The accuracy of the digital examination was examined in relation to maternal and fetal characteristics.*

Results *Digital examination failed to define the correct fetal head position in 17 (26.6%) cases. In 12 of 17 (70.6%) errors the difference was ≥ 90° and in five (29.4%) the difference was between 45° and 90°. The accuracy of vaginal digital examination was 83% for occiput-anterior and 54% for occiput-lateral + occiput-posterior positions. Logistic regression analysis demonstrated significant independent contributions in explaining the variance in the accuracy of vaginal examination for the station of the fetal head, the position of the fetal head and the experience of the examining obstetrician.*

Conclusions *Digital examination during instrumental delivery fails to identify the correct fetal head position in about one quarter of cases. Copyright © 2003 ISUOG. Published by John Wiley & Sons, Ltd.*

INTRODUCTION

Instrumental delivery, by vacuum or forceps, is a common obstetric procedure, which is mainly used for delay or fetal distress in the second stage of labor. However, the use of vacuum or forceps does not always succeed in achieving a vaginal delivery and the use of these instruments is associated with an increased risk for maternal and fetal injury compared with spontaneous vaginal delivery[1–6]. An important determinant of successful and safe use of vacuum and forceps is correct determination of the fetal head position and appropriate application of the instrument. Thus, placement of the vacuum cup on the flexing point and placement of the forceps blades parallel to the sagittal suture are associated with high success rate and reduction in maternal and fetal morbidity[7–9].

Recent studies on the use of ultrasound scanning during labor have reported that clinical examination is highly inaccurate in the determination of the fetal head position[10–13]. Thus, Sherer *et al.*[10,11] examined 214 patients in labor and reported that the findings of digital examination differed from those of sonography by ≥ 45° in 46% of cases. Kreiser *et al.*[12] examined 44 women and reported that the findings of the digital examination were wrong in 30% of cases. Akmal *et al.*[13] examined 496 patients and reported that digital examination failed to define the fetal head position in 34% of cases, and in those in whom the position was defined it was incorrect in 52% of cases since the findings of the digital and sonographic examinations differed by ≥ 45°.

The aim of this study was to examine the accuracy of digital assessment of fetal head position before instrumental delivery.

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PATIENTS AND METHODS

In 64 singleton pregnancies at term the fetal head position was determined by transvaginal digital examination by the attending obstetrician before vacuum extraction or forceps delivery. Immediately before or after the clinical examination and before the application of the instrument, the fetal head position was also determined sonographically, as previously described[13], by a trained sonographer who was unaware of the clinical findings. Essentially, with the patient in a supine position, the ultrasound transducer was placed transversely in the suprapubic region of the maternal abdomen and the fetal head position was defined by visualizing the fetal orbits, midline cerebral echo and cerebellum or occiput. In addition, a transverse section of the fetal chest was obtained at the level of the four-chamber view of the heart and the position of the fetal spine was recorded.

The clinical and ultrasound findings of the fetal position were recorded on a data sheet depicting a circle, like a clock, divided into 24 sections, each of 15°. The digital examination was considered to be correct if the fetal head position was within ± 45° of the ultrasound finding. When the clinical examination was wrong the attending obstetrician was informed of the ultrasound findings.

Statistical analysis

Normality of the distribution of the data was assessed by the Kolmogorov–Smirnoff test. A χ^2 test or Fisher's exact test was used as appropriate to assess the significance of the difference in the percentage accuracy of vaginal examinations between occiput-anterior and occiput-posterior + occiput-lateral positions.

Logistic regression was used to determine which of several independent variables were contributing to the variance in accuracy of vaginal examination in depicting the fetal position before an instrumental delivery. These variables included: maternal age, body mass index and parity, birth weight, position of the fetal occiput and fetal spine and the station of the head were used as continuous numerical variables; presence of caput and use of epidural analgesia were scored as 1 for yes and 0 for no. The variable examiner was scored according to the number of years in training (0 for 2 years, 1 for 3–4 years, 2 for 5–6 years and 3 for consultant-level examiners) and the variable ethnicity was scored as 1 for Caucasian, 2 for Afro-Caribbean and 3 for Asian or Oriental.

RESULTS

The median maternal age was 28 (range, 16–40) years and the median gestational age at examination was 40 + 2 (range, 36 + 4 to 42 + 1) weeks. The characteristics of the population examined are shown in Table 1. The digital examinations were carried out by consultant-level specialists in 17% of cases ($n = 11$) or by trainees with 2 years' ($n = 12$), 3–4 years' ($n = 32$) or 5–6 years' ($n = 9$) experience in obstetrics and gynecology.

Table 1 Characteristics of the population examined and rate of correct identification of fetal head position by digital examination before instrumental delivery ($n = 64$)

	n *(%)*	*Correct (*n *(%))*
Ethnicity		
Caucasian	46 (72)	37 (80)
Afro-Caribbean	1 (2)	0
Asian	17 (27)	10 (59)
Parity		
Nulliparous	52 (81)	38 (73)
Multiparous	12 (19)	9 (75)
Maternal age (years)		
< 20	6 (9)	5 (83)
20–35	54 (84)	41 (76)
> 35	4 (6)	1 (25)
Epidural		
Yes	37 (58)	29 (78)
No	27 (42)	18 (67)
Fetal head position		
Occiput anterior	42 (66)	35 (83)
Occiput lateral or posterior	22 (34)	12 (54)
Station of fetal head (cm)		
0	6 (9)	2 (33)
≥ 1	58 (90)	45 (77)
Caput		
Yes	22 (34)	16 (73)
No	42 (66)	31 (73)
Indication		
Delay in second stage	45 (70)	31 (69)
Fetal distress	19 (30)	16 (84)

The fetal head position was determined by ultrasound examination in all 64 patients examined and the examination took less than 2 min to complete. The fetal head position was occiput anterior in 42 (65.6%) cases, occiput posterior in 14 (21.9%) cases and occiput lateral in eight (12.5%) cases. Vaginal digital examination failed to identify the correct fetal head position in 17 (26.6%) cases (Table 2), including nine (52.9%) in which the difference from the ultrasound finding was 135–180°, three (17.6%) with a difference of 90–135° and five (29.4%) with a difference of 45–90°.

The accuracy of vaginal digital examination was higher for occiput-anterior than it was for occiput-lateral + occiput-posterior positions (83% vs. 54%; Yates-corrected $\chi^2 = 4.7$, $P = 0.02$), and for fetal head below the level of the ischial spines (77% vs. 33%; Fisher's exact test, $P = 0.04$). There was no significant difference in accuracy of digital examination for: nulliparous compared with multiparous women (73% vs. 75%; Yates-corrected $\chi^2 = 0.43$, $P = 0.5$); those with compared with those without epidural analgesia (78% vs. 67%; Yates-corrected $\chi^2 = 0.58$, $P = 0.45$); those with compared with those without fetal head caput (73% for both; Yates-corrected $\chi^2 = 0.008$, $P = 0.9$).

Logistic regression analysis demonstrated that significant independent contributions in explaining the variance in the accuracy of vaginal examination were made by the

Table 2 Distribution of the fetal head position by ultrasound and digital examinations

		Digital vaginal examination	
Ultrasound finding	n *(%)*	*Agreement* n *(%)*	*Other finding*
Direct occiput anterior (DOA)	29 (45)	26 (90)	ROP, ROP, DOP
Left occiput anterior (LOA)	7 (11)	5 (71)	LOL, ROP
Left occiput lateral (LOL)	2 (3)	0	LOA, LOP
Left occiput posterior (LOP)	1 (2)	1 (100)	
Direct occiput posterior (DOP)	5 (8)	2 (40)	DOA, DOA, ROL
Right occiput posterior (ROP)	8 (13)	5 (63)	LOA, LOA, DOA
Right occiput lateral (ROL)	6 (9)	4 (67)	DOA, DOA
Right occiput anterior (ROA)	6 (9)	4 (67)	LOA, LOA

station of the fetal head, the position of the fetal head and the experience of the examiner. The odds ratios and 95% confidence intervals were 4.7 (1.07–21.0) for the station of the fetal head, 0.39 (0.18–0.9) for fetal head position and 2.4 (1.08–5.3) for experience of the examiner.

DISCUSSION

The results of our study demonstrate that vaginal digital examination prior to an instrumental delivery is accurate in defining the fetal head position in only about 75% of cases. Furthermore, the accuracy of digital examination is higher for occiput-anterior than it is for occiput-posterior + lateral positions, it is higher when the station is below rather than at the level of the ischial spines, and it increases with the experience of the obstetrician.

Success of instrumental delivery necessitates correct determination of the fetal head position. In the UK and USA there is a trend for the use of the vacuum extractor as the instrument of choice for instrumental deliveries[14–16]. Incorrect placement of the vacuum cup is associated with high failure rate and an increase in fetal morbidity. In our study the vacuum extractor was used in 89% of cases and there was a major degree of deviation between the findings of ultrasound and those of digital examination in a substantial proportion of cases. In 53% of errors there was a difference of between 135° and 180°, which would have led to a deflexing placement of the vacuum cup, had the attending obstetrician not been informed of the correct position identified by ultrasound. In 18% of errors the difference was 90–135°, implying that the operators were unable to define the sagittal suture of the fetal head, and in 29% of errors the difference was between 45° and 90°, which would have led to paramedian applications of the vacuum cup.

Application of the vacuum cup causing deflexion of the fetal head results in higher failure rate and cup detachment and deflexing application of the cup is more likely to take place in an occiput-lateral or posterior position[7]. Vacca and Keirse[8] examined the outcome of 244 vacuum extractions and reported that application of the vacuum cup was not correct in about half of the procedures and failure rates increased with the magnitude of incorrect application, being 4% for flexing median, 17% for flexing paramedian, 29% for deflexing median and 35% for deflexing paramedian. The neonatal injury rate increased from 5% for flexing median to 45% for deflexing paramedian application. Another study of 28 infants with scalp trauma after vacuum extraction reported that the factors which provided independent prediction of this injury were duration of vacuum application, duration of the second stage of labor and paramedian application of the cup[17].

Mola *et al.*[9] examined the outcome of 59 trials of instrumental deliveries and reported that in the 12 cases in which the trial failed, it was 4.5 times more likely that a deflexing application of the vacuum cup had been performed, 1.5 times more likely for there to have been vacuum cup detachments and twice as likely that the failed instrumental deliveries were performed in the occiput-lateral or posterior position. Low Apgar scores, serious scalp trauma and admission to the neonatal unit were 3.2 times, 5.2 times and 12 times more likely, respectively, in deflexing applications of the vacuum cup and failed trials of instrumental deliveries. Another interesting observation of this study was that deflexing applications of the vacuum cups were associated with a higher number of pulls per case and that the incidence of adverse neonatal outcome increased with the number of pulls. Similarly, Chadwick *et al.*[4], who examined 37 infants admitted to a tertiary referral center with subgaleal hematomas, reported that all but one of the infants had trials of instrumental deliveries. In 89% of cases there was a vacuum extraction and in 52% there was failed instrumental delivery, compared to a background of 13% in the normal population. In 50% of the cases with successful vacuum extraction, the delivery was considered to be difficult, requiring several applications of the vacuum cup.

The subsequent application of forceps after failed trial of vacuum delivery increases the risk for subdural or cerebral, intraventricular and subarachnoid hemorrhage by 7.3, 3.5 and 8.2 times, respectively[15]. In our study and in that of Chadwick *et al.*[4], a significant proportion of failed vacuum extraction deliveries went on to have either trials of forceps delivery (12% of trials of vacuum extraction deliveries in our study) or emergency Cesarean sections. The risks of intracerebral or intracranial hemorrhage increase considerably with multiple attempts at assisted delivery[18]. Furthermore, forceps deliveries are associated with an increased risk of fetal facial injuries and increased maternal morbidity,

including severe vaginal, cervical and perineal lacerations and anal sphincter trauma[1–3,19,20].

In conclusion, we found that digital examination before instrumental delivery fails to identify the correct fetal position in about one quarter of cases. In our study the attending obstetricians were informed of the ultrasound findings and it is therefore impossible to document any adverse effects from incorrect application of the vacuum cup and forceps. Nevertheless, there is extensive evidence that inadequate use of these instruments increases the risks of maternal and fetal mortality and morbidity. Consequently, ultrasound scanning for accurate determination of the fetal head position should be performed routinely before instrumental delivery.

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