

# Reliability of digital vaginal examination for fetal head position determination: A prospective observational study

Zara L.Z. Lok, Michael C.M. Chor

## ABSTRACT

**Aims:** Intrapartum transabdominal and perineal ultrasound is touted as the gold standard for determination of fetal head position, but intrapartum digital vaginal examination is conventional and frequently used on its own despite its inaccuracies. Hence the reliability of digital vaginal examination will be evaluated against intrapartum ultrasound. **Methods:** In a prospective observational study, 50 paired digital vaginal and ultrasound examinations of fetal head position were obtained in a tertiary hospital labor ward. Digital vaginal examination was by the midwives and attending obstetricians who were blinded to the ultrasound findings. A single sonographer performed all transabdominal and perineal ultrasounds for consistency and did not take part in clinical management. **Results:** The median maternal age was 31 years (range 18–37 years) with median gestational age of 40 weeks (range 37–41 weeks). 73.5% ( $n = 25$ ) had spontaneous vaginal delivery. Absolute agreement between ultrasound and digital examination was 54% ( $n = 27$ ) with Cohen's kappa of  $0.073 \pm 0.031$ . Agreement with a 45° allowance was 80% ( $n = 40$ ) with Cohen's kappa

of  $0.728 \pm 0.073$ . Digital exam was more likely to be incorrect ( $p = 0.019$ ) when the fetal head position was occiput posterior ( $n = 5$ , 83.3%) or occiput transverse ( $n = 4$ , 66.7%). **Conclusion:** When compared to intrapartum transabdominal and transperineal ultrasound, digital vaginal examination is unreliable in determining fetal head position, especially when fetal head position is occiput posterior or transverse.

**Keywords:** Fetal head position, Transperineal, Intrapartum ultrasound, Transabdominal

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## INTRODUCTION

Assessment of fetal head rotation and descent is important in the management of women in labor.

The rate of descent and position of head will influence obstetric outcomes such as labor dystocia, choice of instrument for assisted delivery, and success of vaginal delivery [1]. It is well accepted that the fetal head position is an important determinant of the success of vaginal delivery, with occiput posterior positions having a higher rate of instrumental or cesarean deliveries [2] and a higher rate of failed instrumental deliveries [3]. Despite its significant influence on the labor process, fetal head

position is conventionally determined only by digital vaginal examination. Such method of assessment has been criticized for its inaccuracy and poor reproducibility [4, 5]. Akmal et al. showed that digital examination determined the fetal head position wrongly in around one quarter of cases and that the error was more than 90 degrees in about 70% of patients with misdiagnosis [5]. However, such finding is not consistent with our daily observations. In order to determine the reliability of digital vaginal examination in assessment of fetal head position, we decided to prospectively compare findings of intrapartum ultrasound and digital examinations in the assessment of fetal head position during labor. Intrapartum transabdominal and transperineal ultrasonography has been described as a reliable way to determine fetal head position, it will be used as a gold standard of fetal head position [6].

## MATERIALS AND METHODS

This is a prospective observational study. The cohort consists of a non-consecutive series of women who were recruited en bloc from a tertiary university hospital over the course of one month. They were invited to participate and informed consent sought if they were admitted to the labor ward in the active first stage of labor, singleton, at 37 weeks gestation or beyond, and no contra-indications for vaginal delivery or digital vaginal examination. Patient enrollment was carried out when the sonographer with more than 5 years of experience in obstetric ultrasound, was available in the labor ward to perform ultrasounds. The sonographer carried out all the ultrasounds independently and only remained in the labor ward for the sole purpose of sonographic data collection. Obstetricians and certified midwives performed sterile digital examinations when clinically indicated and clinical management was based on their digital vaginal examination findings. Midwives and attending obstetricians were blinded to the ultrasound findings and the sonographer did not take part in clinical management. Ultrasound assessments were performed transabdominally and transperineally using a portable machine (Voluson i; GE Medical Systems) equipped with a 4 to 5 MHz volumetric probe covered by a sterile glove. The position of the fetal head was determined according to methods described in previous literature [7]. The operator first determined the location of the fetal spine with the ultrasound probe placed longitudinally on the mother's abdomen. If the cervical spine is seen at the midline, then the baby is in direct occipital anterior (DOA) position (Figure 1). If the cervical spine can be seen by tilting the probe more than 45 degree from midline, then the baby is in either ROA (right occipital anterior) or LOA (left occipital anterior) position. If the cervical spine can only be seen by putting the probe at either left or right anterior superior iliac spine, the baby is in LOT (left occipital transverse) or ROT (right occipital

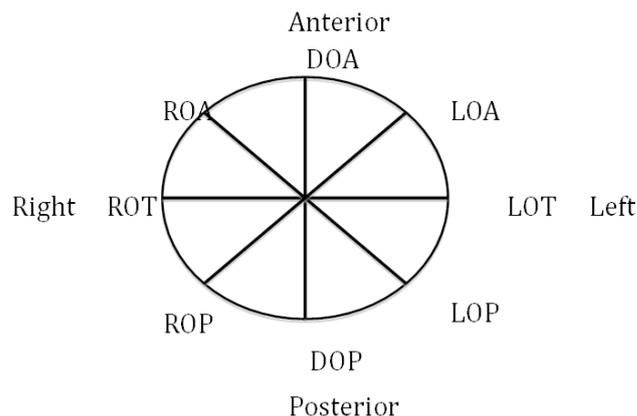


Figure 1: Diagram of positions of fetal head assigned by intrapartum ultrasound and digital vaginal examination.

transverse) position, respectively. If the cervical spine cannot be seen, then the ultrasound probe will be rotated to orientate transversely to the maternal spine and the operator will identify the fetal orbits. Depending on the orientation of the fetal orbits, the head will be classified as DOP (direct occipital posterior), LOP (left occipital posterior) or ROP (right occipital posterior) position accordingly. In case the head is deeply engaged and the operator cannot determine the fetal head position by transabdominal ultrasound, the operator will perform a transperineal ultrasound scan by putting the ultrasound probe longitudinally at the perineum. The operator will look for the falx cerebri of the fetus and hence determine the position of the fetal head. The results of ultrasound and digital examinations were recorded with time of assessment. All paired ultrasound-digital examinations were carried out within a 30-minute interval. Additional digital examinations were performed based on clinical indication but results from unpaired assessments results were not included in our data analysis. After the delivery of the baby, additional information collected included patient demographics, relevant antenatal history, and intrapartum and postpartum outcomes.

Data were analyzed with SPSS version 19.0 (SPSS, Inc., Chicago IL). Univariate comparisons of diagnostic outcomes were performed with chi-square test or Fisher's exact test for nominal variables and logistic regression for continuous variables. Cohen's kappa was used to determine the agreement between digital and ultrasound examinations. A *p*-value of 0.05 or less was considered significant.

## RESULTS

During the study period, 34 Asian women were recruited and assessed by intrapartum ultrasound and digital examination in their active stages of labor. The median maternal age was 31 years (range 18–37 years)

with mean body height 157±6.8 cm. The mean body weight was 59.8 ± 9.9 kg with a BMI of 24.1 ± 3.0. Most (n = 29; 85.3%) patients were nulliparous. Induction of labor was carried out in five patients (14.7%), and the remaining patients had spontaneous onset of labor. Majority of patients (n = 25; 73.5%) had normal spontaneous delivery. There were five vacuum assisted vaginal deliveries (14.7%) and four cesarean sections (11.8%).

Babies were born at a median gestational age of 40 weeks (range 37–41 weeks) with a mean body weight of 3.31±0.38 kg at birth. The median Apgar score was 9 at one minute and 10 at five minutes, and the median umbilical cord arterial pH at birth was 7.23. There were no cases of failed instrumental deliveries and one case with a subarachnoid hemorrhage after ventouse extraction.

A total of 50 paired ultrasound-digital examinations were obtained (Table 1). Absolute agreement between ultrasound and digital examination was 54% (n = 27) with Cohen's kappa of 0.073±0.031. Agreement with a 45° allowance was 80% (n = 40) with Cohen's kappa of 0.728±0.073. Of the 10 digital examination findings with more than 45° error, three incorrectly identified occiput anterior positions for occiput posterior, three mistook occiput posterior for occiput anterior positions, and two incorrectly identified the right-left transverse directions of the fetal head. The remaining two misdiagnosed direct occiput anterior with right and left occiput transverse, suggesting that the sutures were incorrectly identified. Digital examination was more likely to be incorrect (p = 0.019) when the fetal head position was occiput posterior (n = 5, 83.3%) or occiput transverse (n = 4, 66.7%).

When the fetal head position was occiput anterior 63.2% (n = 24) had corresponding findings on digital examination. This effect of fetal head position on error of digital vaginal examination holds true even when a 45° allowance of error is given (p = 0.020). Clinical error was also greater when fetal occiput was on the left as opposed to the right side, 60% (n = 6) versus 25% (n = 6) respectively, although this was not statistically significant (p = 0.071).

## DISCUSSION

Conventionally, intrapartum fetal head position was determined by digital vaginal examination. However, digital examinations in both the active first and second stages of labor are limited by numerous factors such as intra and inter observer error, operator inexperience or fetal factors such as large caput succedaneum [6–9]. Akmal et al. reported 48% accuracy of digital vaginal examination if within 45 degrees of agreement, and that correct determination of fetal position was increased with increasing cervical dilatation [10]. Even then, Souka et al. found that fetal position could not be determined in 31% even at full cervical dilatation, and that clinical inaccuracy was greater with occiput posterior positions [11]. These finding are supported by our study, with only 54% of digital vaginal examinations in absolute agreement with ultrasound findings and occiput posterior and transverse positions having a lower rate of concordance between digital vaginal and ultrasound findings (p = 0.019).

Table 1: Correlation of digital vaginal examination findings versus intrapartum perineal ultrasound findings of fetal head position (n = 50).

		Digital vaginal examination position n(%)							p
		DOA	ROA	ROT	ROP	LOP	LOT	LOA	
Absolute correlation with ultrasound	Yes (n=27)	6 (22.2)	3 (11.1)	0 (0)	1 (3.7)	0 (0)	2 (7.4)	15 (55.6)	.019
	No (n=23)	10 (43.5)	2 (8.7)	1 (4.3)	3 (13.0)	2 (8.7)	3 (13.0)	2 (8.7)	
Correlation with ultrasound ± 45°	Yes (n=40)	13 (32.5)	3 (7.5)	1 (2.5)	3 (7.5)	0 (0)	3 (7.5)	17 (42.5)	.020
	No (n=10)	3 (30.0)	2 (20.0)	0 (0)	1 (10.0)	2 (20.0)	2 (20.0)	0 (0)	

Note: DOA: direct occiput anterior, ROA: right occiput anterior, ROT: right occiput transverse, ROP: right occiput posterior, LOP: left occiput posterior, LOT: left occiput transverse, LOA: left occiput anterior

In past several years, it has been seen that intrapartum ultrasound being touted as the gold standard for intrapartum determination of fetal head position and station [6, 12, 13]. Intrapartum ultrasound has been studied transabdominally and transperineally during both the first and second stages of labor. Transabdominal ultrasound has been shown to be useful but difficult with progressive fetal head descent due to obstruction by the maternal pubic symphysis [14, 15]. Transvaginal ultrasound is reported to be superior in determining fetal head position where transabdominal ultrasound fails to detect position, but only in the hands of a skilled sonographer [16]. The use of transperineal ultrasound is reported more frequently and shown to be a useful adjunct to determine fetal head position, station and descent [1]. In our study we have found that digital vaginal examination is suboptimal when compared to ultrasound for precise determination of the fetal head position. Only when a 45° allowance of error is allowed (i.e., head position  $\pm$  45°), digital examination can be considered in agreement with ultrasound findings. Hence, in circumstances that require a high degree of precision, such as deciding on choice of instrument for instrumental delivery or direction of rotation for manual rotation of fetal head, the use of intrapartum perineal ultrasound will be advantageous. This may especially be the case when accouchers have differing digital examination findings, when the operator is unclear of their digital vaginal examination, or when the operator is planning to embark on an anticipated difficult instrumental delivery.

Digital examination, albeit less accurate than ultrasound, is irreplaceable and a learned skill. Training with ultrasound guidance can enhance and improve digital examination accuracy. Learning to use perineal ultrasound intrapartum has been shown to be easily attainable even by novice operators [17], hence can be of educational value. The use of intrapartum ultrasound will also aid seasoned accouchers where delivery is anticipated to be difficult and can provide objective information to aid clinical decisions. This would be of particular use from a medico-legal standpoint, where findings are documented, objective and can be simultaneously appreciated by other clinicians.

The small cohort size and the single sonographer responsible for all sonographic data collection limit our study. Despite the studies showing the superiority of ultrasound compared to digital vaginal examination, the routine use of ultrasound intrapartum is still uncommon in our locality.

In order for our findings to be applicable to the wider population, further research should ensue with a more powerful cohort and multiple operators of different levels in order to demonstrate the relevance of these findings to midwives and obstetricians in daily practice.

## CONCLUSION

Digital vaginal examination for determination of fetal head position was only correct 54% of the time. Where a 45° error was allowed it was still incorrect 20% of the time. Intrapartum transperineal ultrasound is a useful adjunct to and superior to digital vaginal examination. It should be considered the gold standard in determination of fetal head position and should be an available tool in the labor ward to enhance training in digital vaginal examination accuracy and supplement where digital examination is inconclusive.

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## Author Contributions

Zara L.Z. Lok – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Michael C.M. Chor – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

## Guarantor

The corresponding author is the guarantor of submission.

## Conflict of Interest

Authors declare no conflict of interest.

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