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Original Research Article

Comparison between digital vaginal examination and ultrasound parameters to assess fetal head station and position in labour

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ABSTRACT

Background: The aim was to study the comparison between digital vaginal examination and ultrasound parameters to assess fetal head station and position in labour. The objective was to determine the level of agreement and to compare the findings of clinical examination with intrapartum ultrasound in the determination of fetal head station and position in labour.
Methods: A prospective cohort study was done over a period of 12 months in a tertiary centre. 86 patients were followed up by digital vaginal examination and intrapartum ultrasound for determining the fetal head position and station in active labour. Categorical variables were presented in number and percentage, and continuous variables presented as mean±SD and median. Qualitative variables were correlated using Chi-square test. A p value of <0.05 was considered statistically significant.
Results: The absolute agreement between DVE and intrapartum USG for determining FHP was 43.02% in labour with a composite agreement of 66.67%. The absolute agreement between DVE and Intrapartum USG for determining fetal head station was 68.6% in labour. Accuracy of ultrasound to correctly diagnose fetal head position in labour was found to be 82.14%.
Conclusions: DVE is a subjective tool which can fail to detect the correct fetal head position and station in labour in presence of certain conditions like caput succedaneum and moulding during active labour.

Keywords: Digital vaginal examination, Fetal head position, Fetal head station, Intrapartum ultrasound

INTRODUCTION

Intrapartum ultrasound has indeed gained prominence over the past decade due to a couple of key factors. First, there has been a growing demand for accurate methods to assess labour progress and fetal well-being in real-time. This is particularly important for identifying complications early and guiding clinical decision-making during labor. Second, the increased availability and integration of ultrasound technology into the delivery suite have made it more feasible to use these imaging tools during labour. Advances in portable ultrasound machines and their ease of use have contributed to this trend.[1]

Overall, intrapartum ultrasound can provide valuable information, such as fetal heart rate patterns, fetal position, and amniotic fluid volume, which can help in managing labour more effectively and improving outcomes for both mother and baby.[2]

The idea of using ultrasound for assessing labour dates back several decades. The first significant publication on intrapartum ultrasound appeared in 1977.[3] The introduction of ultrasound offered a new level of precision and objectivity, paving the way for its integration into routine labor management practices. Over time, as ultrasound technology improved and became more

accessible, its role in the delivery suite has expanded, providing real-time data that helps guide labour management and improve outcomes. Digital vaginal examinations are associated with ascending fetal infections, chorioamnionitis and endometritis.[4] The examination itself may also be an uncomfortable experience for the labouring woman.[5]

World Health Organization (WHO) recommends limiting the number of digital vaginal examinations. The National Institute for Health and Clinical Excellence (NICE) has recommended further research aimed at reducing the frequency of digital vaginal examination in normal labour.[6] With the present study, we aimed to determine the level of agreement between digital vaginal examination and intrapartum ultrasound to assess fetal head position and station in labour as well as to compare the accuracy of both the modes of examination to assess different head positions in labour in our setup.

METHODS

This was a prospective cohort study carried out at Southern Railway Headquarters Hospital, Perambur, Chennai, for a period of 12 months from August 2020 to July 2021. Low risk full term pregnant women with singleton pregnancy in the active phase of labour with cephalic presentation were monitored in active phase of labour after obtaining an informed consent.

Detailed clinical examination was carried out for the assessment of cervical status, station of head, membrane status and any cephalopelvic disproportion and to report fetal head position by describing the position of the fetal occiput as the "time on a 12-hour clock". The time required for determining fetal position was recorded. When the sagittal suture of the fetal head could be palpated, but the location of the posterior or anterior fontanelle could not be determined, examiners were asked to report the examination as inconclusive.

Subsequently, a transabdominal and transperineal ultrasound examination was performed with a 5 MHz curvilinear transducer (Aloka). Compliance of preconception prenatal diagnostic techniques act (PCPNDT Act) was strictly adhered. All ultrasonographic assessments were done by the investigator of the study. The person performing the ultrasound examination was blinded to the findings of clinical examination.

Sonographic assessment of fetal head station was performed by transperineal ultrasound in the midsagittal or axial plane. Head station was expressed in cm from the level of ischial spines. Fetal head position by transabdominal ultrasound was defined by visualizing either the fetal orbits or the cerebellum and posterior fossa in occiput posterior and occiput anterior positions, and midline cerebral structures in transverse and oblique positions. The hereby determined position of the fetal occiput was then be recorded in a clockwise fashion, and the time required for this examination was reported. Both examinations were done in the active first stage of labour (cervical dilatation 4-6 cm) and the beginning of the second stage of labour (full dilatation) in the same women. In some cases, in the second stage of labour with deeply engaged head, fetal head position was determined by transperineal ultrasound. The transducer covered with sterile glove was positioned transversely on the perineum halfway between the perineal body and clitoris to achieve a coronal view with reference to maternal anatomy.

The vaginal and ultrasound examinations were compared after complete examination and blinding of both the findings. With progressive decent of fetal head, internal rotation occurs. So, in order to be considered correct, an examination had to be within 45 degrees of the observed delivery position, unless there was an observed spontaneous or manual rotation subsequent to the examination. If a determination of occiput position could not be made on an examination, it was marked as incorrect.

A total 86 patients were enrolled in the study and were followed up by DVE and intrapartum ultrasound to determine the fetal head position and station in the active first stage (cervical dilatation 4-6 cm) and in the second stage of labour. Categorical variables were presented in number and percentage, and continuous variables were presented as mean±standard deviation (SD) and median. Qualitative variables were correlated using Chi-square test. Inter rater κ agreement was used to find out the strength of agreement between FHP by DVE and ultrasonography (USG). A p value of <0.05 was considered statistically significant. The data was entered in MS Excel spreadsheet, and the analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

RESULTS

A comprehensive overview of the demographic and clinical characteristics of patients included 45.35% women aged 26-30 years of age with 53.49% primigravida in the study. 51.16% of the patients belonged to upper middle socio-economic status. Among the study population, 43.02% of the study participants were found to be overweight. Mean gestation of pregnancy was 271.29±7.37 days among the study participants. 17.44% women progressed spontaneously while 82.56% needed augmentation with syntocinon for inadequate contractions, poor progression of labour. The mean duration of first and second stages of labour was 347.22±130.9 minutes and 46.19±29.04 minutes respectively in the study.

Table 1: Frequency distribution of study participants by background characteristics.

Background characteristics		Number	Percentage
Age groups (in years)	18-20	1	1.16
	21-25	28	32.56
	26-30	39	45.35
	31-35	14	16.28
	36-40	4	4.65
Gravida	Primi	46	53.49
	Multi	40	46.51
Socio-economic status	High	3	3.49
	Upper middle	44	51.16
	Lower middle	36	41.86
	Low	3	3.49
BMI	<18.5	3	3.49
	18.5-24.9	36	41.86
	25-29.9	37	43.02
	≥30	10	11.63
Booking status	Booked	82	95.35
	Unbooked	4	4.65
Onset of labour	Spontaneous	21	24.42
	Induced	65	75.58
Progression of labour	Syntocinon augmentation	71	82.56
	Spontaneous	15	17.44

Table 2: Comparison of the fetal head position by ultrasound and vaginal examination.

FHP (fetal head position)	Actual no. diagnosed by Digital vaginal examination		Actual no. diagnosed By ultrasound		Agreement of ultrasound with digital vaginal examination	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
ROA	9	10.47	8	9.3	3	37.5
ROT	9	10.47	8	9.3	1	12.5
ROP	2	2.33	9	10.47	1	11.11
LOA	33	38.37	21	24.42	14	66.67
LOT	22	25.58	34	39.53	16	47.06
LOP	8	9.3	2	2.33	1	50
DOA	3	3.49	2	2.33	1	50
UN			2	2.33		
Total	86	100	86	100	37	43.02

Table 3: Precision and level of agreement between digital examination and ultrasound to assess different fetal head positions.

	Digital vaginal examination (%)							
Ultrasound	**ROA**	**ROT**	**ROP**	**LOA**	**LOT**	**LOP**	**DOA**	**Total**
ROA	3 (37.5)	4 (50)	(0)	(0)	(0)	1 (12.5)	(0)	8 (100)
ROT	5 (62.5)	1 (12.5)	(0)	(0)	2 (25)	(0)	(0)	8 (100)
ROP	(0)	4 (44.44)	1 (11.11)	3 (33.33)	(0)	1 (11.11)	(0)	9 (100)
LOA	(0)	(0)	(0)	14 (66.67)	4 (19.05)	1 (4.76)	2 (9.52)	21 (100)
LOT	(0)	(0%)	(0)	14(41.18)	16 (47.06)	4 (11.76)	(0)	34 (100)
LOP	1 (50)	()	(0)	(0)	(0)	1 (50)	(0)	2 (100)
DOA	(0)	(0)	(0)	1 (50)	(0)	(0)	1 (50)	2 (100)
UN	(0)	(0)	1 (50)	1 (50)	(0)	(0)	(0)	2 (100)
Total	9 (10.47)	9 (10.47)	2 (2.33)	33 (38.37)	22 (25.58)	8 (9.3)	3 (3.49)	86 (100)

Table 4: Level of agreement between fetal head station determined sonographically and by digital vaginal examination.

Fetal head station	Actual station determined by digital vaginal examination		Actual station determined by ultrasound		Agreement of ultrasound with digital vaginal examination	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
-3	1	1.16	0	0		
-2	0	0	1	1.16		
-1	0	0	0	0		
0	1	1.16	0	0		
+1	55	63.95	52	60.47	42	80.77
+2	26	30.23	29	33.72	15	51.72
+3	3	3.49	4	4.65	2	50.00
Total	86	100	86	100	58	67.44

Table 5: Accuracy of ultrasound to assess fetal head position.

Fetal head position	Fetal head position by ultrasound	Outcome at birth	
		Agreed cases/total cases	Agreement%
DOA	2	2/2	100
LOA	21	20/21	95.24
LOP	2	2/2	100
LOT	34	27/34	79.41
ROA	8	5/8	62.5
ROP	9	7/9	77.78
ROT	8	6/8	75
UN	2		

Comparison of the fetal head position by ultrasound and vaginal examination

Table 2 shows agreement of digital vaginal examination with ultrasound was 66.67% for left occipito-anterior (LOA), 50% for direct occipito-anterior (DOA), 50% for left occipito-posterior (LOP), 47.06% for left occipito transverse (LOT), 37.5% for right occipito-anterior (ROA), 12.5% for right occipito-transverse (ROT) and 11.11% for right occipito-posterior (ROP) head positions.

Precision and level of agreement between digital examination and ultrasound to assess different fetal head positions

Table 3 shows right occipito-anterior (ROA): 37.5% (3) cases were assessed as ROA by both the modes.

Other findings on DVE were 50% ROT, 1% LOP.

Right occipito-transverse (ROT): 12.5% (1) case was assessed as ROT by both the modes of examination. Other findings on DVE were 62.5% ROA, 2% LOT.

Right occipito-posterior (ROP): 11.11% (1) case was diagnosed as ROP by both modes of examination. Other findings on DVE were 44.44% ROT, 33.33% LOA, 11.11% LOP.

Left occipito-anterior (LOA): 66.67% (14) cases were diagnosed LOA by both modes of examination. Other findings by DVE were 19.05% LOT, 9.52% DOA, 4.76% LOP

Left occipito-transverse (LOT): 47.06% (16) cases were diagnosed as LOT by both the modes of examination. Other findings by DVE were 41.18% LOA, 11.76% LOP.

Left occipito-posterior (LOP): 50% (1) case was diagnosed as LOP by both modes of examination. Other findings by DVE were 50% ROA.

Direct occipito-anterior: 50% (1) case was diagnosed as DOA by both modes of examination. Other findings by DVE were50% LOA.

Unidentified (UN): Fetal head position couldn't be determined in 2 (2.33%) cases whereas head position was assessed in 100% cases through digital vaginal examination.

Level of agreement between fetal head station determined sonographically and by digital vaginal examination

Table 4 shows among the study population, level of agreement between ultrasound and digital vaginal

examination for +1 fetal head station was 80.77% (42); for +2 station 51.72% (15) and +3 station 50% (2).

Patients' preference for ultrasound and digital vaginal examination

66.28% (57) women preferred ultrasound as mode of examination, 17.44% (15) women found no difference between digital examination and ultrasound, 16.28% (14) women didn't comment on mode of examination comfortable and none of the women chose vaginal examination as a preferred mode for assessing fetal head position and station

Accuracy of ultrasound to determine fetal head position

Intrapartum USG accurately assessed direct occipito-anterior in 100% (2) cases, left occipito-posterior in 100% (2) cases, 95.24% (20) cases, left occipito-transverse in 79.41% (27) cases, right occipito-posterior in 77.78% (7) cases, right occipito-transverse in 75% (6) cases and right occipito-anterior in 62.5% (5) cases. Overall accuracy of USG to assess different fetal head position in labour was determined as 82.14%.

DISCUSSION

In the present study, 24.42% (21) patients entered labour spontaneously, while 75.58% (65) were induced as institutional protocol for induction at 38 weeks in COVID pandemic, GHTN, post-dated pregnancy, PROM, pre-eclampsia, gestational diabetes. 17.44% (15) women progressed spontaneously into active phase of labour while 82.56% (71) needed augmentation with syntocinon for inadequate contractions, poor progression of labour.

Mean±SD determined for duration of first stage of labour was 347.22±130.9 minutes and that for second stage of labour was 46.19±29.04 in the present study as compared to 269.88±128.96 minutes for first stage stage and 59.55±32.96 minutes for second stage in the study by Gizzo et al.[7]

Agreement of DVE with USG was 66.67% for LOA, 50% for DOA, 50% for LOP, 47.06% for LOT, 37.5% for ROA, 12.5% for ROT and 11.11% for ROP head positions with an overall agreement between intrapartum USG and DVE to determine fetal head position as 43.02%. Chan et al reported an absolute agreement between vaginal examination and USG in 30% cases.[8] Sherer et al reported absolute agreement in 40% of cases (p=0.044) in the second stage of labour.[9] They reported a composite agreement of 68%. Dupuis et al studied 110 patients and reported 70% absolute agreement between vaginal examination and USG in the second stage of labour.[10] Shetty et al reported absolute agreement between vaginal examination and USG in 31.5% cases in the first stage of labour which was lower than present study.[11]

Zara et al reported absolute agreement between vaginal examination and USG in 54% of cases and the composite agreement was in 80% of cases.[12] Akmal et al studied 64 patients, reported 73.43% agreement in determining the FHP when digital examination was within ±450 of the USG findings.[13] In the present study, we found that digital examinations are reliable foe the anterior positions in labour but failed to detect correct head position in the transverse and posterior positions of the head.

Among the study population, vaginal examinations were carried out by junior resident doctors in 60.47% (52) women, by Senior resident doctors in 23.26% (20) and by consultants in 16.28% (14) women. As mentioned earlier, before or after this vaginal examination, transverse suprapubic transabdominal and transperineal real-time intrapartum ultrasound fetal head position and station assessment was performed by the principal investigator with blinded findings.

This study has some limitations. Smaller group of women were sampled which were not representative of a larger population. Narrow range of demographic population was included in the study. Population that differs in locality, socioeconomic status was not sampled. Confounding factors like BMI, induction of labour and augmentation with syntocinon could have been avoided at the beginning of the study and it would have given better statistical results. Cost effectiveness of use of both the modalities of examination was not studied. Comparison between frequency of per vaginal examination and incidence of neonatal sepsis rate was not undertaken in this study. Use of other ultrasound parameters for synctilism, asynclitism and sonopartogram was not done.

Clinical significance

Intrapartum ultrasound can be used before instrumental delivery, to assess fetal head position and station. This will help in better application of vacuum cup, and to predict the chances of successful instrumental delivery. This overall can decrease second stage caesarean section rates. Ultrasound is an objective method and guidelines based on ultrasound needs to be developed for intervention in second stage of labour for CPD. This will help in decision making. It will also help in the medico-legal aspects. Till now, guidelines for maximum duration of labour and details to intervene are unclear. Better guidelines and more objective methods are needed for labour monitoring. Combined transabdominal and transperineal ultrasound determination of fetal occiput position and station is a superior approach than vaginal examination. Larger prospective observational studies on the subject needs to be conducted in Indian population with similar demographic characteristics.

CONCLUSION

Intrapartum ultrasound, if not substitute the traditional digital vaginal examination, should at least be used in

aiding to assess fetal head station and position in labour. Digital vaginal examination is a subjective tool and can fail to detect the correct fetal head position and station in labour in presence of tense bag of membranes, caput succedaneum and moulding in active labour. Despite the fact that all the studies agreed with the favourable findings of these procedures, only a few maternity care givers use intrapartum ultrasound since the successful interpretation of USG depends on the experience and skill of the practitioner, on whether it is used routinely or selectively and on the timing of its performance.

Intrapartum USG should be used to confirm the fetal head position and station prior to instrumental delivery and cesarean section which will facilitate correct application and prevent intrapartum complications with less maternal and neonatal morbidities and good perinatal outcomes.

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