Original Article

A Clinical Study on Progress of Labor using Ultra Sound during Parturition: Analysis of 71 Patients

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Abstract

Introduction: The progress of active labor by transvaginal examination is a subjective evaluation of the obstetrician with many limitations. The current trend in obstetrics is to avoid vaginal deliveries. There are many scientific proposals to monitor the progress of the active labor using ultrasound in laboring patients.

Aim: To clinically assess the active labor and compare with ultrasound to accurately and objectively monitor the progress of normal labor as well as to predict successful vaginal birth.

Materials and Methods: In total, 71 patients with full-term primigravida attending the Department of Obstetrics and Gynecology in active first stage labor were included. Patients with cephalic presentation with occipitoanterior were included. Initial per vaginal (PV) examination followed by transabdominal ultrasound and later trans-vaginal ultrasound were used to visualize the infrapubic plane. At rest and at peak uterine contractions, the parameters of ultrasound were used to for the ability to detect the engagement of fetal head and for the occurrence of vaginal delivery.

Results: About 68.40% of the patients felt ultrasound examination more convenient than PV examination. The dynamic progression distance with a cutoff of 23.21 mm recognized patients who will deliver virginally. The sensitivity of the ultrasound examination during intrapartum was 70.6%, and the specificity was 79.9%. The sensitivity of dynamic angle of progression was 81.2% and a specificity of 84.30%. There was a statistical correlation between cervical diameter assessed using PV examination and using ultrasound during labor with P = 0.041 (P significant at <0.05).

Conclusion: Ultrasound examination during active labor provided an accurate scientific assessment of birth progress. The study could identify the group of patients in active labor at high risk of surgical delivery.

Key words: Labour, Parturition, Progress of labour, Ultrasound

INTRODUCTION

The main objective of obstetricians is to deliver a healthy baby to a healthy mother in each and every pregnancy attended by them. In spite latest advancement in sophisticated modern obstetrics the complex process of parturition is assessed by per vaginal (PV) subjective clinical assessment by the treating obstetrician. The current trend of obstetricians is to avoid difficult vaginal deliveries. Despite being the "gold standard" of obstetric practice, the clinician's skill resides mainly in digital PV examination which is subjective evaluation with several limitations.[1] Nowadays compact, mobile, high-resolution real-time ultrasound machines are available at the patient's bedside which helps in continuous ultrasound examination even by non-ultrasound-trained professionals.[2] Review of the current literature shows a rapid accumulation of ultrasound knowledge in regards with intrapartum sociological findings.[3] Active labour ultrasound examination helps to understand the complex physiology of birth and also provides dynamics of different stages of labour; its prognosis and high risk of vaginal delivery.[4] Assessment of fetal head station in relation to the narrowest part of the pelvis is very important in assessing the progress of vaginal delivery. The fetal head diameter is used as an internal pelvimeter. The studies have shown that ultrasound imaging might allow dynamic and objective quantification of the level of fetal head descent in the birth canal.[5,6]

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Different ultrasound methods are used in the intrapartum determination of fetal head engagement.[2] Intrapartum translabial ultrasound helps in finding the fetal station in as much accuracy as with that of digital PV examination in the second stage and also helps in guides in the choice of instrumental delivery.[5,7-11] Translabial ultrasound also helps in objective quantification of the level of the head descent in the birth canal. A "progression distance" of the fetal head was described as the minimal distance from a line through the inferoposterior symphyseal margin (parallel to the main transducer axis) and the leading edge of the fetal skull. This may also help in determining the progress of the head in the second stage of labor (2, 5, and 11). Another parameter is the "angle of progression" of the fetal head, described as the angle between a line through the midline of the pubic symphysis and a line from the inferior apex of the symphysis to the leading part of the fetal skull.[7] The angles of progression show an intra- and inter-observer variability for the measurement that was <3.[12]

Aim of the Study

To clinically assess the active labor and compare with ultrasound to accurately and objectively monitor the progress of normal labor as well as to predict successful vaginal birth.

MATERIALS AND METHODS

A total of 71 patients who are primigravida, full term and in active labor attending the Obstetrics and Gynecology Department of tertiary teaching hospital of Kannur medical college were included in the study. The study period is between January 2012 and December 2015.

Inclusion Criteria

(1) Patients belonging to primigravid status were included, (2) patients in active phase of the first stage of labour were included, (3) patients with cephalic presentation with occipito anterior presentation were included, (4) patients completing 37-41 weeks of gestation were included, (5) patients with spontaneous active phase of labor; with regular rhythmic uterine contractions and dilatation of the internal cervical of beyond 4 cm were included.

Exclusion Criteria

(1) Patients with antenatal and antepartum complications were not included, (2) patients with diabetes mellitus, pre-eclampsia, and hydramnios were not included, (3) patients with abnormal presentations such as occipito posterior, twins, oligohydramnios, and transverse lie were excluded, (4) patients with abnormalities of the amniotic fluid and/or placenta, maternal spine and/or pelvic disease and/or fractures were excluded, (5) postcesarean patients

were excluded. For all the patients, a single physician was involved in doing the intrapartum ultrasound examination, but actual managing obstetricians were blinded to the results of the intrapartum ultrasound. Complete obstetric history and clinical examination followed by PV examination of all the patients was done. This was followed by ultrasound examination. The clinical findings of PV examination and ultrasound examination are kept blind to one another of the doctors examining. Maternal, fetal, and birth characteristics of the study group were collected for statistical analysis, including mode and time of delivery. A 3.5 MHz curved array ultrasound transducer was used. Initially, a per abdominal, obstetrical ultrasound was first performed for fetal well-being and biometry; bi-parietal diameter (BPD), head circumference, abdominal circumference, and femur length and expected fetal weight calculated using Hadlock's formula 15; then, the probe was positioned trans labially along the sagittal plane to reveal the pubic symphysis joint. For standardization, the transducer was placed so that the symphysis was in a horizontal position, the fetal skull of which the anterior and lowermost parts were clearly observed and the dorsal part of the birth canal: Soft tissue and sacrococcygeal bones were also observed. The plane encompassing these anatomical structures was referred to as the infrapubic plane. In this plane station of the fetal head within the maternal pelvis was determined by measuring the progression distance described as the minimal distance (in mm) from a line through the inferoposterior symphyseal margin (parallel to the main transducer axis) and the leading edge of the fetal skull. In the same plane, the angle of progression of the fetal head, described as the angle between a line through the midline of the pubic symphysis and a line from the inferior apex of the symphysis to the leading part of the fetal skull is measured. Data were analyzed using the online socialsciencestatistics.com methods. Quantitative data were described using mean and standard deviation.

OBSERVATIONS AND RESULTS

A total of 71 patients attending the Obstetrics and Gynecology Department of a tertiary teaching hospital attached to Kannur Medical College, Anjarakandy, Kannur were included in the present study. The mean age was 26.40 ± 2.60 years. All the patients were Primigravid. The mean gestational age based on the last menstrual period was 39.3 weeks ranging from 37 to 41 weeks of amenorrhea? The mean fetal birth weight was 3101.5 ± 210.5 g with a mean BPD of 8.6 ± 0.5 cm and only 1% of newborns were admitted to the neonatal intensive care unit all following vaginal delivery. The mean cervical dilatation among the studied population PV examination nearly 6 cm ranging from 5 to 9 cm dilatation and 56% of patients had their

membranes spontaneously ruptured at the time of the first examination. Furthermore, 32.6% of patients had the fetal head engaged during their first examination. 68.40% of the patients expressed their discomfort toward PV examination and considered it worse than translabial ultrasound. The remaining patients found both, U/S and PV examination, to be equivocal. 85% of patients delivered vaginally as compared to 15% who delivered by CS, and only one patient delivered vaginally using obstetric forceps, The correlations and associations using transabdominal ultrasound; 60.6% of all fetuses were in the left dorsoanterior position (LDA). The identification of fetal head position by PV was not possible in 21.5% of all PV examination, whereas ultrasound was capable of describing fetal position in all patients. However, there was no statistical significance between ultrasound and PV findings regarding fetal position ($P = 0.078$ with P significant at <0.05). Fetal membrane status observation using ultrasound was found to be with a sensitivity of 69.5%; in detecting intact membranes with a very high specificity of more than 93%. There was statistical significance between the ultrasound examination and PV exam the $P = 0.023$. As for the assessment of cervical dilatation, a statistically significant correlation was found between the diameter assessed using PV examination and using ultrasound ($P = 0.346$). Clinically assessed cervical dilatation correlated positively with fetal head station assessed by ultrasound exam ($P = 0.045$). The sensitivity of the ultrasound examination during intrapartum was 70.6%, and the specificity was 79.9%. The statistical correlation between PV exam and ultrasound exam was found to be highly significant with $P = 0.012$. The mean value of the "dynamic progression distance" of the fetal head (=during uterine contraction and/or fundal pressure) was 24.2 ± 13.4 mm. The receiver operating characteristic (ROC) curve produced showed an area under the curve (AUC) = 0.93 at a high level of statistical significance ($P < 0.001$). The sensitivity and specificity of such a measure was 89% and 71.1% respectively for a cutoff of 20.4 mm in detecting fetal head engagement

DISCUSSION

The current trend in obstetric practice is to avoid risky vaginal deliveries and go ahead with cesarian sections in difficult deliveries. The gold standard of assessment of progress of labor is subjective digital examination PV which has several limitations.[2] Review of the current literature shows a rapid accumulation of ultrasound knowledge in regards with intrapartum sonological findings.[3] In the present study, 68.40% of the patients felt Ultrasound examination more convenient than PV examination? This could be taken as a potential of the technique since

intrapartum epidural analgesia is not in routine use in our labor ward. Ultrasound examination showed 60.6% of all fetuses were in the LDA position confirming the original observation of Caldwell *et al*.[13] The fetal head usually engages in the occipitotransverse position, more commonly in the left than right position. The identification of the fetal head position by PV was not possible in 21.5% of all examinations in the present study. Whereas ultrasound exam could show the fetal head position in all the patients. However, no significant agreement was found between the ultrasound and PV examination findings; $P = 0.078$ with P significant at <0.05). Few studies considered PV digital examination as being less accurate than ultrasound exam for determining the fetal head position during the first stage of labor.[14,15] Few studies demonstrated an overall high rate of error (76%) in PV digital compared with ultrasound determinations of fetal head positioning during active labor.[16] Due to high rate of disparity between PV and ultrasound examinations few authors have even suggested regular use of ultrasound in early first stage of labor.[17-19] Fetal membrane status observation using ultrasound was found to be with a sensitivity of 69.5%; in detecting intact membranes with a very high specificity of more than 93%. There was statistical significance between the ultrasound examination and PV exam the $P = 0.023$. In obstetric practice, at least 10% of the patients require confirmation of premature rupture of membranes. In doubtful cases, pH measurement of vaginal secretions and ultrasound examinations are used. Some studies even measured the thickness of fetal membranes for the prediction of the risk of preterm birth.[20] As for the assessment of cervical dilatation, a statistically significant correlation was found between the diameter assessed using PV exam and using ultrasound ($P = 0.346$). Clinically assessed cervical dilatation correlated positively with fetal head station assessed by ultrasound examination ($P = 0.045$). The sensitivity of the ultrasound examination during intrapartum was 70.6%, and the specificity was 79.9%. The statistical correlation between PV examination and ultrasound examination was found to be highly significant with $P = 0.012$. Ultrasound examination showing various adaptations of the fetal head to the maternal pelvis, as molding of the fetal head, have been reported since the early nineties.[21] In the present study, 85% of patients delivered vaginally as compared to 15% who delivered by CS, and only one patient delivered vaginally using obstetric forceps. The assessment of fetal head station with regard to the narrowest part of the maternal bony pelvis is of crucial importance for vaginal delivery to occur. Therefore, engagement of the fetal head can be used as an "internal pelvimeter" to determine whether the bony birth canal is sufficiently wide for an individual fetus.[22] The mean value of the "dynamic progression distance" of the fetal head (=during uterine contraction and/or fundal pressure) was 24.2 ± 13.4 mm.

The ROC curve produced showed an AUC = 0.93 at a high level of statistical significance ($P < 0.001$). The sensitivity and specificity of such a measure was 89% and 71.1% respectively for a cutoff of 20.4 mm in detecting fetal head engagement.

CONCLUSIONS

Intrapartum translabial ultrasound is a simple technique that improves the understanding of normal and abnormal labor, enables the objective measurement of birth progress and provides a more scientific basis for assessing labor.

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