

Research Article

The role of Intrapartum Translabial Ultrasound to Predict Successful Vaginal Birth In Ladies With Previous Caesarean Section

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Abstract

Objective: To evaluate the role of intrapartum translabial ultrasound to predict successful vaginal birth in ladies with previous caesarean section. **Patients and methods:** 200 pregnant women with previous caesarean section admitted during the active phase of the first stage of labor. **Results:** At a cut-off value 2.5mm the sensitivity of the progression distance was 89.3% and 71.4% specificity in prediction of vaginal delivery. Using 100.5 degree as a cut-off value for the angle of progression to identify patients who deliver vaginally gives 88.5% sensitivity and 74.3% specificity. **Conclusion:** Intrapartum translabial ultrasound is a useful tool to predict occurrence of vaginal delivery in women with previous caesarean.

Keywords: VBAC, intrapartum ultrasound, translabial ultrasound, progression distance, angle of progression.

Introduction

Witnessing a dramatically increasing rates of CS deliveries mainly due to the practice of defensive medicine⁽¹⁾, repeat CS is central to that practice.

Although being the ‘gold standard’ in obstetric practice, the digital transvaginal examination is a subjective evaluation and has several limitations⁽²⁾.

A growing body of knowledge is accumulating regarding intrapartum ultrasound as a relatively new application of ultrasound. Intrapartum ultrasonography can provide objective information on the dynamics of different stages of labor⁽³⁾, and may also be used to assess labor progression, predict labor outcome and to predict the prognosis for operative vaginal delivery⁽⁴⁾.

Translabial ultrasound was used to demonstrate pelvic floor structures, it was shown to be fast, safe, reliable, easy to learn and readily available tool⁽⁵⁾.

Aim of the work

To assess the ability of intrapartum translabial ultrasound to objectively predict the progress of labor and the occurrence of successful vaginal

birth in ladies with previous CS attempting for VBAC at term pregnancy.

Patients & Methods

This study included 200 pregnant women, All with previous CS. The same operator performed all ultrasound studies, The managing obstetricians were blinded to the ultrasound results.

Inclusion criteria: Full term (37:41weeks) singleton pregnancy, and Spontaneous onset of the active phase of 1st stage of labor as evidenced by regular uterine contractions and dilatation of the internal cervical OS ≥ 4 cm.

Exclusion criteria: Abnormal fetal presentations, congenital fetal malformations, abnormalities of the amniotic fluid or placenta, maternal spine or pelvic disease or fractures, and complicated pregnancies.

Full history and complete clinical examination were undertaken for all participants.

This approach was to reveal anatomical structures in the ‘infrapubic plane’: The symphysis pubis, the lowermost parts of fetal skull, and the dorsal part of the birth canal. For standardization the transducer was placed so

that the symphysis will be in a horizontal position. In this plane, the progression distance was measured. Described as the minimal distance [c] (in mm) from a line [b] placed vertical to the central axis of the symphysis pubis [a], placed through the infero-posterior symphyseal margin, and the leading edge of the fetal skull. (fig. 1 a)

In the same plane, the angle of progression of the fetal head was measured, described as the angle [b] between a line through the midline of the pubic symphysis [a] and a line from the inferior apex of the symphysis to the leading part of the fetal skull [c] (fig.1 b).

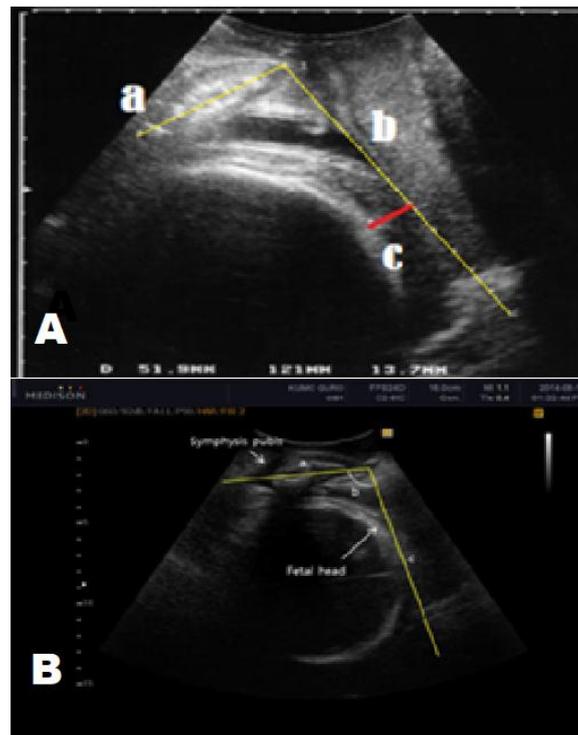


Fig.1 (A: Head progression distance ⁽⁶⁾, (B: Angle of progression of fetal head.⁽³⁾

Results

Mean patient age was 28.2 ± 4.5 . Gravidity was ranging from 2:4. The mean gestational age was 38.2 ± 0.8 weeks. By PV digital examination, the mean cervical dilatation was 4.56 ± 0.87 cm (from 4-8 cm), 19% of cases had their membranes spontaneously ruptured at time of examination. 5.5% of patients had trial of VBAC under epidural analgesia.

49 cases had vaginal delivery, 3 of them delivered by vacuum to shorten the 2nd stage. TOLAC ended by CS delivery in 75.5% of cases, 72.84% of them had a CS for non-progressive labor. Failure to progress was stated according to the definition of the American College of Obstetricians and Gynecologists (ACOG) ⁽⁷⁾.

Intrapartum bleeding reported in one case and delivery was by CS, it was found to have dehiscence uterine scar during CS.

Fetal head position was detected by transabdominal US in 100% of cases. Whilst PV examination failed to detect head position in 16%, No significant agreement between head position detected by US and By TV examination ($r=0.123$).

The mean PD was 2.9 ± 6.0 mm, ranging from -15:18mm. It differ significantly between the vaginal and the CS groups ($p=0.0005$), and in turn there was significant difference among CS indicated by failure to progress and CS due to other causes ($p < 0.001$). (tab1)

Table 1: values of tested parameters in different groups.

Group		PD	AoP
Vaginal delivery	Spontaneous	6.10±6.1 (-13 : 13)	105.9±6.1 (89:115)
	Vontose	-2.33±6.0 (-10 : 2)	103.6±5.5 (99:108)
CS	Failed progress	-9.40±5.1 (-17 : -4)	96.6±7.4 (86:105)
	Other indications	-3.85±5.3 (-15 : 8)	100.4±6.7 (98:112)

In 89.8% of vaginal deliveries, the measured PD was ≥ 2.5 mm while it was ≤ 2.5 mm in 71.5% of CS cases. At a cut-off value of 2.5mm the sensitivity was 89.3% and 71.4% specificity in prediction of vaginal delivery.

At a significant statistical value (AUC=0.833, $p < 0.001$) the same cut off value, the sensitivity and specificity of the PD for detection of “failure to progress” was 91.3% and 78% respectively (fig.2).

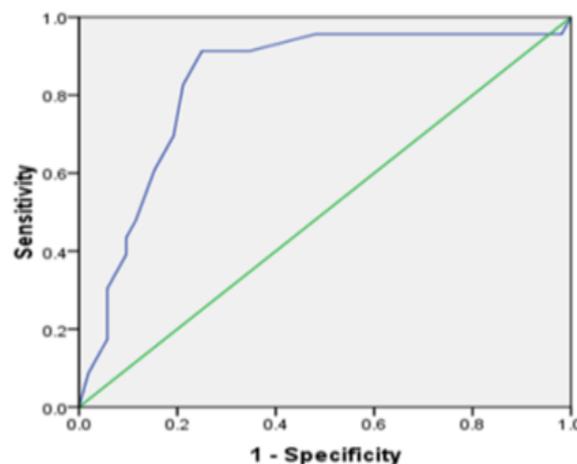


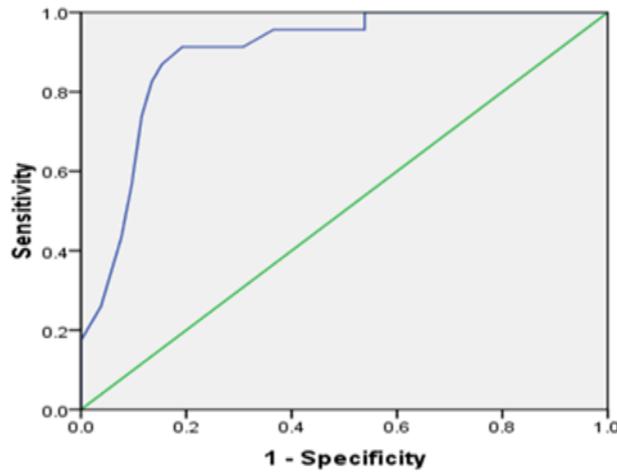
Fig.2: ROC curve PD in the subgroup of “failure to progress”

The mean AoP was $100.8 \pm 6.97^\circ$, ranging from 86 to 115. In women with spontaneous vaginal delivery the mean AoP was $105.0 \pm 5.99^\circ$, while in women with CS it was $98.4 \pm 6.7^\circ$, the difference was found to be of good significance ($p < 0.001$)

A cut-off value of 100.5° , showed the best statistical significance ($p < 0.001$), such value will have a sensitivity of 80.3% and specificity of 85.6% in detecting the engagement of the fetal head compared to digital PV examination.

The AoP was measured ≥ 100 in 87.7% of patients who had VBAC while it was < 100 in 73.5% of cases who delivered by CS. At a statistically significant level ($P = 0.001$) using 100.5° as a cut-off value to identify patients who deliver vaginally gives 88.5% sensitivity and 74.3% specificity.

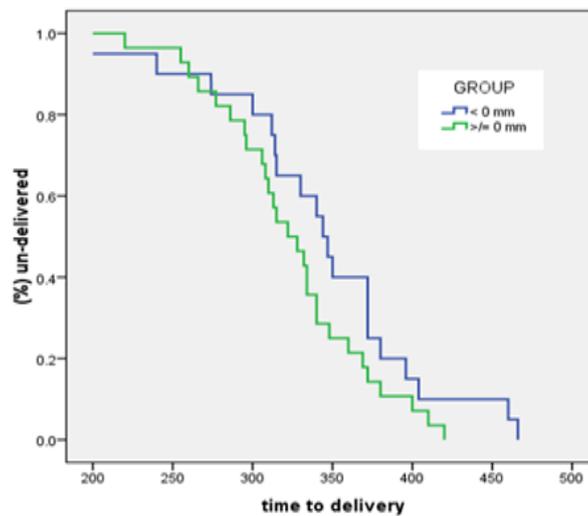
In the subgroup of “ failed progression”, the same cut off value, gives higher sensitivity (91.3%) and specificity (80.8%) at a statistically significant level (AUC=0.896, $P < 0.001$).



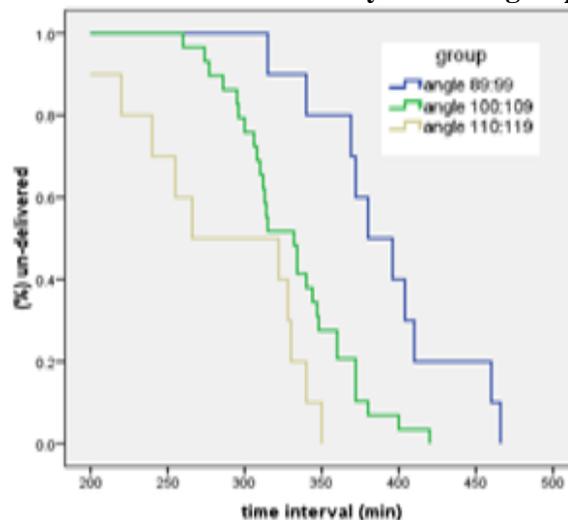
(Fig. 3): ROC curve showing the ability of the AoP in predicting failure of progression

there was noticed significant correlation between both wider AoP and longer PD with shorter interval to delivery ($p < 0.001$, $p < 0.05$ respectively). Time to delivery was 6hours+31 min when AoP was below 99° , 5 hours+ 30 min

when AoP between 100 and 109 , and 4 hours+45 min with angle ≥ 110). longer PD was found to have similar effect (5 hours+54 min with PD less than 0 mm, 5 hours+24 min if PD is ≥ 0 mm).



(Fig. 4): Kaplan-Meier curve of time to delivery in 2 sub-groups according to PD.



(Fig. 5): Kaplan-Meier curve of time to delivery in 3 sub-groups according to AoP

Discussion

The identification of the fetal head position by PV was not possible in 16% of cases, no significant agreement was found between the ultrasound and PV examination findings ($r=0.123$). Many studies observed transvaginal digital examination as being less accurate than ultrasonography for determining the fetal head position during the first stage of labor With high rate of error^(8,9). In a study by Usman et al.,, Fetal head position was recorded in 99.7% of US and 51.5% on vaginal examination ($p<.0001$)⁽¹⁰⁾. Some studies even recommended the routine use of ultrasound in early first stage of labor or prior to instrumental delivery for accurate detection of fetal head position⁽¹¹⁾. Several studies have shown that digital determination of fetal head station in laboring women is imprecise even in the hands of experienced examiners⁽¹²⁾.

One of the most studied ultrasound parameters to detect fetal head engagement to predict mode of delivery is the angle of progression of fetal head⁽¹³⁾. In the current work we tested a relatively new parameter - the progression distance - in addition for the main purpose. Dietz et al., first described the PD of the fetal head. They provided evidence that the PD was correlated well with the fetal head station⁽⁶⁾. The studied PD differ significantly among different reports, due to different methodology used in PD measurement and different population groups, also most of the reports focus on PD in prolonged 2nd stage of labor⁽¹⁴⁾.

Our mean PD (-2.9 ± 6.0 mm.) was near to that from the original work of Dietz et al.,. They reported a mean of -6.7 mm. Taking in consideration that their study was on non-labouring women, it may explain our shorter PD.

The ability of the PD at a cut-off value of 2.5mm to predict VBACK, has sensitivity of 89.3% and specificity of 71.4%. It was raised to 91.3% and 78% respectively when used more specifically to predict unsatisfactory labor progress.

These findings are in agreement with Henrich et al.,⁽¹⁵⁾ they used 3D-CT reconstruction of pelvimetric measurements of normal female pelvis in correlation with intrapartum US and

confirmed that the infrapubic plane lies cranial to the level of the ischial spines and hence the plane of fetal head engagement.

In a study by Erik et al.,⁽¹⁶⁾ PD was found to be significantly longer ($p=0.01$) in women who delivered vaginally compared to those who had CS for obstructed labor. But due to lack of standardization of the used measurement method, their values were far from ours (2.51 ± 1.71 cm and 1.48 ± 1.9 cm).

The mean value of the 'AoP' was $105.0 \pm 5.99^\circ$ in cases who delivered vaginally, a lower value was found in cases delivered by CS ($98.4 \pm 6.7^\circ$). This difference was of high statistical significance ($p < 0.001$).

The same angle was studied by Omar et al., they found similar difference between both groups (104 ± 16.6 and 88.3 ± 14)⁽¹⁷⁾. Also Lavy et al., found a narrower angle in patients who went for CS (90 vs 104). But the later study was conducted on patients who are not in active labor⁽¹⁸⁾.

The AoP value obtained by this study to identify head engagement (100.5) is apparently lower than the 123 reported by Chan et al.,⁽¹⁹⁾, and the 116 reported by Tutschek et al.,⁽⁸⁾ It is, however, closer to the 101 obtained by Yaw et al.,⁽²⁰⁾. However, these studies all agree on station 0 typically corresponding to an AoP above 99.

Using the same cut-off value to predict occurrence of vaginal delivery, it gives 88.5% sensitivity and 74.3% specificity at a statistically significant level ($P=0.001$). and to predict slow labor progress, it gave higher sensitivity (91.3%) and specificity (80.8%).

Some consecutive studies have shown that AoP is more accurate than digital examination in predicting vaginal delivery in nulliparous women with prolonged first stage of labor^(21,22). Several studies with conflicting results have attempted to solve the issue of the correlation between a specific AoP and fetal head station within the birth canal. A MRI study by Bamberg et al.,⁽²³⁾ found that an AOP of 120° corresponded to a fetal head station of 0. In another study by Barbera et al.,⁽²⁴⁾ developed a geometric model from CT images and from TLUS. they concluded that a TLUS angle of 100° correlated with zero station of the fetal head.

The results of the current study agreed with the work done by Barbera et al., as the cut-off for the prediction of fetal head engagement was above 99°. Moreover, cases who delivered vaginally had the mean values above 99° unlike those who delivered by CS⁽²⁴⁾.

It was noticed that wider AoP were associated with significantly decreased time to delivery. This is in agreement with Ghi et al.,⁽²⁵⁾ and Bianca et al.,⁽²⁶⁾, however, the later reported that the impact on clinical practice seems low.

Conclusion

TLUS is a useful feasible acceptable and safe adjunctive assessment tool in the evaluation of laboring women trying to have vaginal delivery with a prior CS.

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