

Transperineal ultrasound. An objective and efficient method to assess fetal head descent in the second stage of labor

Abstract

Objective. The aim of this study was to identify patients who will undergo vaginal delivery or cesarian section correlating clinical station with transperineal ultrasound (TPU) measurements during the second stage of labor. **Methods.** Our study included 88 laboring patients with unique, term pregnancies and cranial presentation which were clinically and by TPU examined. TPU appreciated fetal head descent measuring the angle between the longitudinal axis of the pubic symphysis and a tangential axis to the fetal skull. Intra- and inter-examiner variability was noticed. **Results.** A significant association was noticed between digital examination and the angle of fetal head descent. An angle of at least 120° during the second stage of labor was associated with vaginal delivery. Six cases of cesarean section resulted in average angle of descent of 108° . **Conclusions.** Our data suggest that TPU measurement of progression angle can be an objective method for estimating with accuracy and reproducibility the descent of fetal head.

Keywords: transperineal ultrasound, fetal head descent, progression angle, digital examination

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The transperineal ultrasound is proved to be a useful tool in assessing fetal head descent during the second stage of birth.

Introduction

Assessing the progression of labor and fetal head descent especially, is particularly useful in terms of the practitioner but also a challenge because these rely on a proper assessment of optimal obstetric attitude.

In the second stage of labour fetal station is clinically assessed to evaluate the fetal head descent, to identify distocia and to decide the delivery type⁽¹⁾. Assessment of fetal head station with regard to the narrowest part of the maternal bony pelvis is of crucial importance if safe operative vaginal delivery is to be attempted⁽²⁾.

The diagnosis of failure of descent, using serial digital examinations, is currently based on the clinical perception that the presenting fetal part is not descending through the pelvic canal⁽³⁾.

The assessment of fetal head station in labor has always been based on the relationship between the leading edge of the fetal head and maternal pelvic landmarks, namely the ischial spines⁽⁴⁾. However, even among experienced clinicians there is substantial variability in the interpretation of fetal station, reflecting how difficult and unreliable this clinical evaluation can be, especially when caput and/or molding are present. Therefore, a more objective method for assessing fetal station would result in better informed decisions regarding failure of progress in labor. Ultrasound imaging has already been reported as alternative method

for evaluating the level of the fetal presenting part within the maternal pelvic canal⁽⁵⁾.

The first objective of this study is to assess the feasibility and reproducibility of measuring station and observing descent of the fetal head using transperineal ultrasound (TPU) examination. The second one is to compare the clinical evaluation of fetal station through digital examinations with concomitant TPU assessments of station. The third is to investigate trends in TPU data in laboring patients that could help to identify those who would go on to vaginal delivery rather than needing cesarean section for failure to progress. This, in turn, could be useful in developing a decision-making strategy to determine the need for operative delivery in patients progressing slowly through the second stage of labor.

Methods

The beginning of our experimental work was developed in Clinic of Obstetrics and Gynecology, Bucur, Bucharest in 2009 being completed in 2011. Out of a total number of 4749 patients admitted and treated in our hospital there were 88 laboring patients that were included in the study. Informed consent was obtained from each patient before taking part in the experimental study. This number represents the number of real cases that we could closely monitor using the TPU examinations. Active labor was demonstrated by regular uterine contractions and changes in cervical dilatation of more than 2 cm. All women had a live singleton pregnancy with the fetus in cephalic presentation and a gestational age of more than 37 completed weeks dated by first- and/or mid-trimester scan.

Received:
2nd July 2012
Revised:
20th September 2012
Accepted:
2nd October 2012

Patients were examined in their labor rooms. The probe was enclosed in a latex glove covered with ultrasound gel and was placed between the labia below the pubic symphysis. The sagittal view, in which the long axis of the pubic symphysis could be ascertained, was obtained by gently moving the transducer upward. While in this same plane, the leading portion of the fetal head could easily be identified. On the sagittal image a line was drawn on the screen between calipers placed at the two points identifying the long axis of the pubic symphysis. A second caliper line was then created on the frozen image that extended from the most inferior portion of the pubic symphysis tangentially to the fetal skull contour. The angle between the constructed lines was then measured directly on the screen or with a goniometer applied to a hard-copy image.

Station was determined by assessing the relationship between the most distal cranial point and the level of the ischial spines. TPU scans were performed at different times during labor for the 88 subjects included in the study, with measurements in most cases from repeated (two to five) scans at each examination and averaged to produce a single estimated value of the angle of descent. For assessments performed during the second stage of labor the time was noticed and later used to calculate the interval from scanning to delivery. In all cases measurements were performed in concert with digital examinations.

In order to assess interobserver variability, a second independent and well trained observer, blinded to the others' results, obtained 15 duplicate sets of scans at different times of labor among 12 randomly selected women.

Assessments of fetal head station were performed by digital examination conducted by the managing clinician,

who was not involved in the study and was blinded to the ultrasound data.

In order to determine whether the time to delivery was associated with the TPU progression angle, TPU angles were divided into four groups: $\leq 130^\circ$ (1st quartile), $131^\circ - 170^\circ$ (2nd quartile), $171^\circ - 200^\circ$ (3rd quartile) and $> 200^\circ$ (4th quartile), with the intervals chosen to minimize the proportion of repeated measurements obtained from the same patient in each group.

Results

Intraobserver analysis

Among all patients assessed by TPU examination in this study, 75 had at least one set of two or five replicated scans obtained at approximately the same time. These patients provided a total of 172 sets of scans, comprising one to eight separate assessments per patient at various times throughout labor, which were used to assess intraobserver variability.

Eighty-two patients delivered via normal spontaneous vaginal delivery in an anterior occiput position (right or left) and six patients were delivered by cesarean section.

The intra-observer variability of the angle of head descent measured on TPU examination, resulted from the replicated TPU assessments performed by the primary observer at each assessment time, was very low.

Assessment of clinical head station

There was a significant linear correlation between the angle of descent measured on TPU and the clinical station assessed by digital examination ($R^2 = 0.2859$, $P < .001$) (Figure 1).

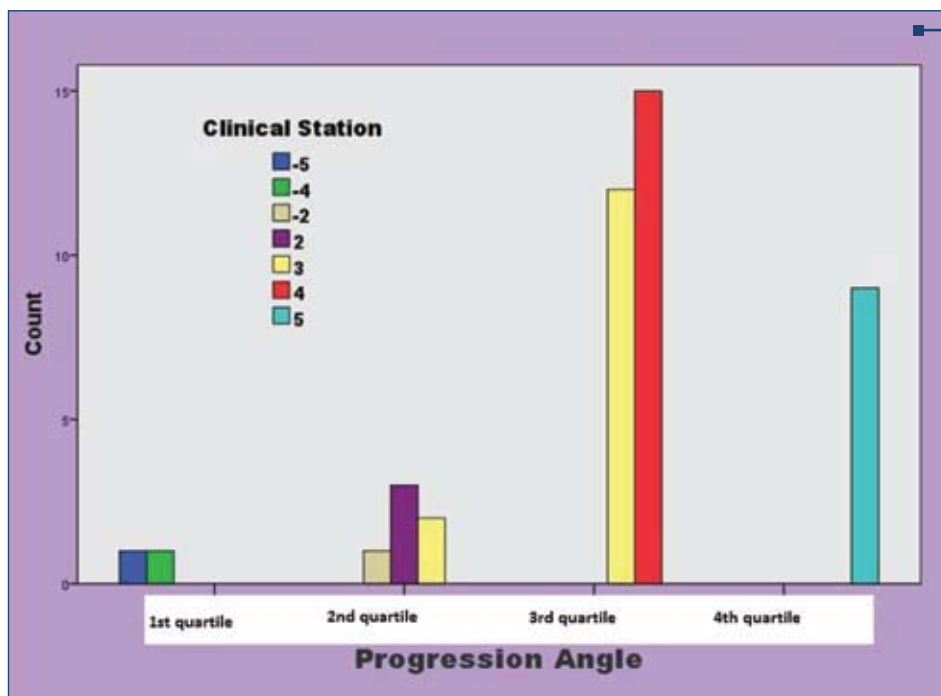


Figure 1. TPU progression angle, clinical station

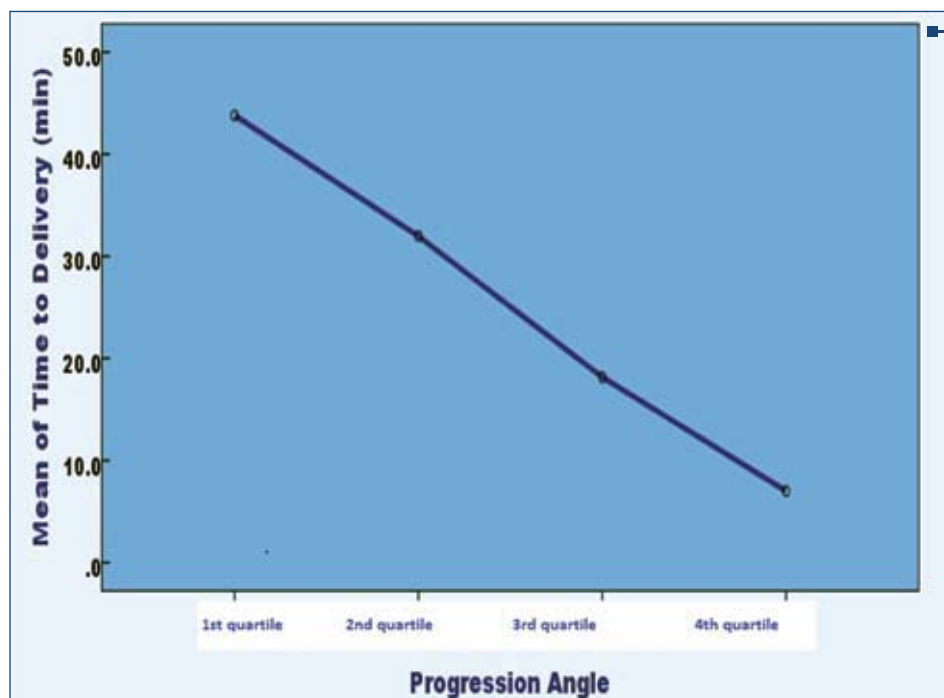


Figure 2. TPU angle - time to delivery

Association between angle of head descent on TPU examination and time to delivery

Seventy-one sets of measurements, consisting of TPU angle and time until delivery, were obtained from 23 women during the second stage of labor.

The group with the smallest angles ($\leq 135^\circ$), the first quartile, had a significant higher time to delivery (median 41,47) than the other groups 2nd quartile: median=31,96 min (range, 12–27) ; 3rd quartile: median=12.0 min; 4th quartile: median=7.0 (Figure 2). The decrease in time to delivery

became relatively smaller as the value of the angle increased. In all women, once full dilatation was attained, a TPU angle of greater than 120° was associated with engagement of the head assessed by clinical examination.

Moreover, in all the vaginal deliveries there was a consistent increase in TPU angle, and spontaneous delivery occurred in all cases in which the TPU angle exceeded 120° .

Among the six patients who underwent cesarean section, the average TPU angle at the time of the last examination was 108° and none achieved a TPU angle of $>120^\circ$ (Figure 3). In all cases, clinical digital assessment of fetal head station was +2 or more.

TPU limitations

When a posterior occiput is suspected, we recommend caution in interpreting the results, mainly for prolonged labors when diagnosis by clinical examination is difficult. In these cases, the association of TPU could be helpful and can highlight the posterior occiput, in which, although the TPU examination reveals that fetal skull remains horizontal, the angle of progression may be overstated (Figures 4 and 5).

Discussion

Having in the view major progress in clinical obstetrics, the evaluation of fetal head descent including monitoring of the progress in fetal head through the birth canal still remain subjective.

Many practitioners have tried to eliminate subjectivity and appreciable errors in assessing progress and the presentation by introducing parameters of reproducible and objective benchmarks as determined by TPU applied during the second stage of labor.

Assessing labor progression, Richey et al.⁽⁶⁾ appreciated it on a line between the perineum and fetal skull. Dietz



Figure 3. TPU angle = 80° , caput succedaneum, cesarian section

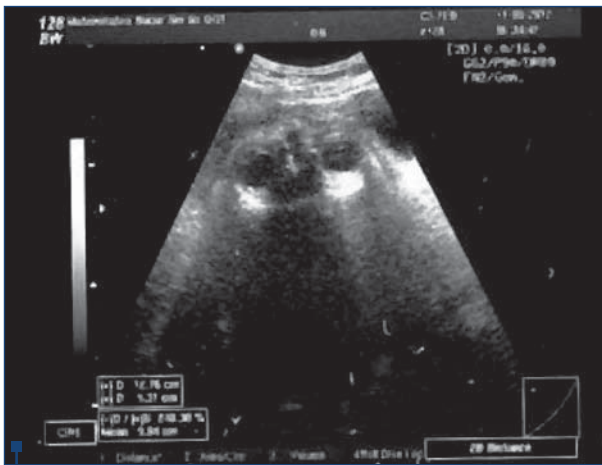


Figure 4. Transabdominal view, TPU angle = 120°



Figure 5. Occiput posterior, caput succedaneum, TPU angle = 120°

and Lanzarone⁽⁷⁾ used as benchmarks the pubic symphysis and the distal section of the fetal skull to appreciate the fetal skull descent at TPU examination. Heinrich et al.⁽⁸⁾ defined the 'direction' of fetal skull as an axis perpendicular to the direction of the largest diameter of fetal skull in an infrapubic plan. Eggebo et al. have shown that fetal skull-perineum distance measured by TPU can appreciate a successful spontaneous vaginal delivery⁽⁴⁾.

Considering the anatomical shape of the pelvis axis, the TPU measurements of the angle between the pubic symphysis and the fetal skull reveals an accurate image of what really happens during the descent through the maternal birth pathway. The angle of descent is more appropriate than traditional methods in evaluating the station.

The estimation of a low intraobserver variability for the measurement of angle of head descent at TPU examination obtained in our study reveals an acceptable level of variability.

Interestingly, a negligible inter-observer variance component, obtained by simultaneously assessing intra- and interobserver variation, indicates that assessments among different observers are no more variable than replicated measurements generated by the same observer at the same time, with the intraobserver variability itself relatively small.

The angle between the long axis of the pubic symphysis and a line extending from its most inferior edge tangentially to the fetal skull was easily measured by TPU imaging.

The low intra- and interobserver variability reveals the accuracy of this technique. In addition, the relationship

between fetal head descent assessed by digital examination and by TPU imaging clearly shows a particularly poor correlation in mid-station (clinical station, -2 to 0), reflecting how difficult it is for clinicians to accurately quantify clinical head station using the more subjective method of digital examination.

The progression of fetal head descent in cases with a posterior occiput is more complex and less predictable. TPU examinations in fetuses with such malpresentation may be less helpful. In association with transabdominal ultrasound we may have a higher rate of success in assessing patients who will go on to vaginal delivery rather than cesarian section for failure to progress.

Conclusions

Even if clear data in the literature support the role of TPU examination in monitoring the progress of the second stage of labor, the limited number of cases we examined by TPU do not have a strong statistical significance and may also need further examinations in order to improve our data. Our results supports the aim that the angle of progression is a reproducible, and non-invasive measurement in assessing fetal skull progression through the maternal birth canal, using precise landmarks.

In addition, further studies regarding TPU imaging may consider it an accurate tool in managing the real failure to progress in labor and may aid in guiding clinicians with regard to operative vaginal delivery. Moreover, studies should investigate the role of this measurement in fetal and maternal outcome prediction. ■

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