Research Article

Prediction of Vaginal Delivery Using Fetal Head Descent Assessed Using Transperineal Ultrasound

Penilaian Penurunan Kepala dengan USG Transperineal untuk Penentuan Keberhasilan Persalinan Pervaginam

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Abstract

Objective: To evaluate the use of transperineal ultrasound in predicting the successfulness of vaginal delivery.

Methods: This was a prospective study conducted at Karawang District Hospital during the period between March 2016 and May 2016. Inclusion criteria were term pregnancy, singleton live head presentation, and active phase of labor. Using transperineal ultrasound, fetal head perineum distance, and angle of progression within relaxation phase between contraction were being calculated.

Results: There were 306 subjects who delivered vaginally. The cut off value for fetal head perineum distance as a predictor of vaginal delivery was 43.5 mm (sensitivity 91%, specificity 78%), with area under a curve of 82% (95% CI 69 - 95%, p < 0.01); while angle of progression is 107° (sensitivity 80 %, specificity 97%), with Area under curve is 96.4% (95% CI 87 - 99%, p < 0.01).

Conclusion: Fetal head perineum distance and angle of progression can predict the successfulness of vaginal delivery.

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Keywords: angle of progression, fetal head-perineum distance, prediction of vaginal delivery, transperineal ultrasound

Abstrak

***Tujuan**: Mengetahui bahwa USG transperineal dapat memprediksi keberhasilan persalinan pervaginam.*

***Metode**: Penelitian ini merupakan uji prognostik dengan desain Kohort yang berlangsung pada bulan Maret hingga Mei 2016 di RSU Daerah Karawang. Dengan kriteria inklusi adalah perempuan hamil aterm, presentasi kepala dan janin tunggal hidup yang sedang dalam persalinan kala I aktif, dan yang menjadikan kriteria eksklusi adalah malpresentasi, disproporsi kepala-pelvik, pengakhiran kehamilan dengan seksio sesarea pada saat pemantauan dengan indikasi bukan karena persalinan macet. Subyek penelitian sebanyak 323 orang, dilakukan pemeriksaan ultrasonografi transperineal, dilakukan pengukuran jarak kepala-perineum dan sudut kemajuan pada saat fase relaksasi di antara kontraksi dan dipastikan kandung kemih kosong. Sebelumnya telah dilakukan uji kesesuaian antar observer. Analisis data menggunakan uji Mann Whitney, dan dicari masing-masing titik potong optimal menggunakan ROC. Dari berbagai titik potong dilakukan analisis bivariat, seleksi variabel dimasukkan dalam analisis multivariat (bila p < 0,25), dan kualitas hasil dilihat dari nilai Area Under Curve (AUC).*

***Hasil**: Sebanyak 306 subjek melahirkan spontan dan 13 subjek melahirkan berbantu alat. 4 subjek (1,3%) melahirkan dengan seksio sesarea. Didapatkan titik potong untuk jarak kepala - perineum adalah 43,5 mm, sensitivitas 91%, spesifisitas 78%, sebanyak 89% lahir pervaginam dan dengan Area Under Curve untuk memprediksi persalinan pervaginam adalah 82% (IK 95%, 69 - 95%) (p<0,01). Sedangkan titik potong sudut kemajuan sebesar 107° dengan sensitivitas 80%, spesifisitas 97% sebanyak 75% lahir pervaginam dan dengan Area Under Curve 96,4% (IK 95%, 87- 99%) (p<0,01) untuk memprediksi persalinan pervaginam.*

***Kesimpulan**: Jarak kepala - perineum dan sudut kemajuan dapat memprediksi keberhasilan persalinan pervaginam.*

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***Kata kunci**: jarak kepala - perineum, persalinan pervaginam, sudut kemajuan, USG transperineal*

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INTRODUCTION

Identifying a fetal head descent to avoid vaginal delivery complications is considered a challenge in obstetric practice.[1-8] The fetal head descent has become a routine evaluation indicator during delivery to predict any delivery progress.[2,3,9-13] If the fetal head does not descent normally, it is one of the arrest of descent sign which eventually the obstetrician must interfere the delivery process using additional instrument or proceed the cesa-

rean section.[13,14] The over 90 diagnosis of arrest of descent increase the cesarean section procedure rate.[1-3,15-18] Newer methods are required to distinguish whether a woman has a high or low successful rate for vaginal delivery. The intrapartum ultrasound is needed to confirmed the diagnosis on the active phase of labor.[3,4,5,19] This study is aimed to evaluate transperineal ultrasound in predicting the successfulness of vaginal delivery.

METHODS

This was a prospective study conducted at Karawang District Hospital during the period of March 2016 to May 2016. The inclusion criteria were term pregnancy, singleton live head presentation, and active phase of labor. The exclusion criteria were maplresentation, cephalo-pelvic disproportion, and cesarean section pregnancy termination with non arrest of descent indication. There were 323 subjects, examined using transperineal ultrasound, and calculated the fetal head perineum distance, and angle of progression within relaxation phase on empty bladder and between contraction. Analysis was carried out using Mann-Whitney test, and optimal cut off point was determined using ROC. Using a bivariate analysis from a few different cut off point, variable selection counted as multivariate analysis if $p<0.25$, and the Area Under Curve (AUC) to evaluate the quality of the result.

RESULTS

Demographic characteristics of the subjects are presented in Table 1. 194 (61%) subjects were multigravida and 306 (94.7%) subjects had spontaneous delivery.

Validity test was performed on 50 subjects with one time calculation on the fetal head perineum distance and the angle of progression which were evaluated by the first observer and re-evaluated by the second observer. The Cronbach's alpha score was 0.92 with 0.86 intraclass correlation coefficient (ICC) score for angle of progression and 0.99 Cronbach's alpha score with 0.98 intraclass correlation coefficient score for the fetal head perineum distance. This study has a very good balance on evaluation between the observers.

Table 1. Demographic Characteristics of the Subjects

Parameter	Median (range) or N (%)
Maternal Characteristics	
Mother's Age	28 (15 - 45)*
Gestational age	39 (37 - 41)*
BMI	29 (25 - 38)*
25 - 29 kg/m^2	210 (65)+
30 - 33 kg/m^2	87 (27)+
> 34 kg/m^2	26 (8)+
Previous C-section	11 (3.4)+
Primigravida	129 (39)+
Multigravida	194 (61)+
Delivery Characteristics	
Labor Induction	153 (47.3)+
Spontaneous	170 (52.7)+
Augmentation	18 (5)+
Delivery mode	
Spontaneous	306 (94.7)+
Instrumental	13 (4)+
C-section	4 (1.3)+
Neonatal Characteristics	
Low birth weight	3100 (2500 - 4000)*

Normality test was performed to determine the sample data distribution. An abnormal data was found with Kolmogorov Smirnoff test ($p>0.05$). Mann Whitney test was used to evaluate the angle of progression between the spontaneous delivery group and the instrumental delivery group with the end result was $p = 0.024$.

Table 2. Successful Vaginal Delivery Prediction Parameter

Variable	Vaginal delivery		p
	Spontaneous delivery (n=306) Median (min-max)	Instrumental delivery (n =13) Median (min-max)	
Angle of progression	114 (104 - 120)	102 (96 -110)	0.007
Fetal head perineum distance	34 (18 - 45)	26 (38 - 56)	0.024

With Chi square test, the angle of progression variable and the fetal head perineum variable had a significant statistical result. In a multivariate or logistic regression test, these variables could be a factor to predict vaginal delivery using AUC : 96.4% (CI 95%, 97-99%) and 82.4% (CI 95%, 69-95%).

The angle of progression cut off point as a successful vaginal delivery predictor was 107° with 80% of sensitivity and 97% of specificity. The fetal head perineum distance cut off point was 43.5 mm with 91% of sensitivity and 78% of specificity.

DISCUSSION

This median age of the subjects was 28 years old. BMI median was 29kg/m^2, 202 spontaneus delivery with BMI between 25-29 kg/m^2, 9 instrumental delivery subjects, and 2 cesarean section subjects. There were 80 cesarean section subjects and 4 instrumental delivery subjects with BMI between 30-33 kg/m^2. There were 23 spontaneous delivery subjects, 1 instrumental subject, and 2 cesarean section subject with BMI >34 kg/m^2. This result showed there was no between larger BMI with increasing cesarean section rate.

There were 129 primigravida subjects, 120 spontaneous delivery subjects, 6 instrumental delivery subjects, and 3 cesarean section subjects. The fetal head perineum distance on cesarean section subject was 46-56mm and the angle of progression between 96-106°. This result showed that the fetal head perineum distance <43.5 mm with >107° angle of progression could predict the succession of vaginal delivery on primipara. Eggebo and Torkildsen research showed that transperineal ultrasound could predict the succession of vaginal delivery on primipara.[2-13]

There were 194 multigravida subjects consisting of 11 subjects with previous cesarean section, 185 subjects with spontaneous delivery, 8 subjects with instrumental delivery, and 1 subject with cesarean section. On the cesarean section subject, the fetal head perineum distance was 45mm and the angle of progression was 96°. This result showed that the fetal head perineum distance and the angle of progression could predict the successfulness of vaginal delivery. Eggebo and Torkildsen research showed that transperineal ultrasound could predict the successfulness of vaginal delivery on multipara.[17,19-25]

Eleven subjects with previous cesarean section history underwent vaginal delivery. There is no evidence about successful rate of vaginal delivery on previous cesarean section subjects, hence the angle of progression and the fetal head perineum distance could be used as a predictor of successfulness for vaginal delivery on previous cesarean section subjects and as the next guideline for future research of transperineal ultrasound as a predictor of successfulness for vaginal delivery on previous cesarean section subjects.

In this study, transperineal ultrasound could predict vaginal delivery on the first active phase of labor. The cut off point score for the angle of progression as a predictor of successfullness for vaginal delivery was 107° with 80% of sensitivity and 97% of specificity, as much as 75% of the subjects were proceed with a vaginal delivery with AUC 96.4% (CI 95%, 87-99%). The cut off value for the fetal head perineum distance as a predictor of successfullness for vaginal delivery was 43.5 mm with 91% of sensitivity and 78% of specificity, as much as 89% of the subjects were proceed with a vaginal delivery with AUC 82,4% (CI 95%,

Table 3. Successful Spontaneous Delivery and Instrumental Delivery Prediction Using Bivariate and Multivariate Analysis

Variable	Spontaneous delivery (n = 306)	Instrumental delivery (n = 13)	Non - Adjusted			Adjusted[a]		
			p	OR	CI 95%	p	OR	CI 95%
Angle of progression								
< 107°	6 (2.2%)	3 (80%)	**<0.001***	0.64	1.06 - 7.34	**0.047***	23.3	1.03 - 523.5
≥ 107°	309 (97.8%)	1 (20%)						
Fetal head perineum distance								
< 43.5 mm	310 (98.1%)	1 (20%)	**<0.001***	7.33	1.13 - 47.60	**0.033***	0.34	0.01 - 0.86
≥ 43.5 mm	5 (96.6%)	4 (80%)						

**p< 0.05; aadjust based on power/his*

69-95%). Eggebo and Torkildsen research showed that on the first active phase of labor, 110° was the cut off point where we could predict the successfulness of vaginal delivery as much as 88% with AUC 76% ($p>0.05$) and the 40mm cut off point from the fetal head perineum distance could predict 92% vaginal delivery with AUC 81% ($p<0.05$).[2-13]

CONCLUSION

The angle of progression and fetal head-perineum distance can predict the successfulness of vaginal delivery. With 107° angle of progression cut off point, obtained 80% of sensitivity and 97% of specificity, as much as 75% subjects were proceed a vaginal delivery with AUC 96.4% to predict vaginal delivery. Within the fetal head perineum distance cut off point with 43.5mm, obtained 91% of sensitivity and 78% of specificity, as much as 89% subjects were proceed a vaginal delivery with AUC 82.5% to predict vaginal delivery. Future studies regarding transperineal ultrasound as a predictor labor induction successfulness according to delivery methods should be performed.

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