

# Correlation Between the Head Progression Distance Using Intrapartum Transperineal Ultrasound and the Bishop Score Using Digital Examination in Assessment of Labor Progress

Ahmed El-Habashy

Department of Obstetrics and Gynecology, Faculty of Medicine, Alexandria University, Egypt

## ABSTRACT

**Aim:** Evaluation of the role of head progression distance (PD) using the transperineal ultrasound (TPUS) in assessment of progress of labor.

**Materials and Methods:** This study conducted on 60 cases admitted to El-Shatby Maternity University Hospital in active phase of labor, at full term with singleton pregnancy presented by vertex. We measured the head progression distance (PD) in each case on admission, after 1 hour and after 2 hours (using transperineal ultrasound) and correlated it with the Bishop score by digital examination. We documented also the mode of delivery in all cases.

**Results:** The mean head progression distance (PD) had a statistically significant association with the fetal head station on admission, after 1 hour and after 2 hours. HPD will get longer with the progress of labor with the fetal head descent. The sensitivity of Bishop score on admission to predict the mode of delivery was 58.33% at cut-off 7, after 1 hour it was 75% at cut-off 9 and after 2 hours it was 91.67% at cut-off 10. The sensitivity of head progression distance (PD) on admission to predict the mode of delivery was 66.67% at cut-off 44mm, after 1 hour it was 75% at cut-off 51mm and after 2 hours it was 91.67% at cut-off 63mm.

**Conclusion:** Head progression distance (PD) measurement using intrapartum transperineal ultrasound (TPUS) is correlated with Bishop score using digital examination. The increasing PD with progress of labor is associated with more likelihood of vaginal delivery. PD can be used for objective assessment of progress of labor.

**Key Words:** Head progression distance, head station, intrapartum ultrasound, transperineal ultrasound.

**Received:** 15<sup>th</sup> January 2021, **Accepted:** 2<sup>nd</sup> November 2021

**Corresponding Author:** Ahmed El-Habashy, Department of Obstetrics and Gynecology, Faculty of Medicine, Alexandria University, Egypt, **Tel.:** +20 11005 85634, **E-mail:** ahmadelhabashy@yahoo.com

**ISSN:** 2090-7265, August 2022, Vol.12, No. 3

## INTRODUCTION

Progress of labor is determined by following the maternal cervical dilatation and the fetal head decent. The later can be assessed by abdominally or vaginally. Fetal head decent can be assessed during abdominal examination either by role of fifth or by the 4th Leopold manure. The standard clinical practice is to assess the fetal head station is by digital vaginal examination (DVE); where "0" station identified when the lowest bony part of the fetal head reach the level of the ischial spines<sup>[1,2]</sup>.

Bishop score is a clinical predictive system (by vaginal examination) designed to assess the probability of achieving successful vaginal delivery and the need for cervical ripening. Bishop score >8 suggest successful vaginal delivery and score <6 suggest that cervical ripening is required. The 5 components of the Bishop score are listed in (Table 1), for each component the case take a score 0-3 and the sum of each component's score will be the Bishop score<sup>[3,4]</sup>.

**Table 1:** Components of the Bishop score<sup>[3]</sup>

Variable	Bishop Score			
	0	1	2	3
Dilatation (cm)	0	1-2	3-4	5-6
Effacement (%)	0-30	40-50	60-7	≥80
Station	-3	-2	-1,0	+1
Consistency	Firm	Medium	Soft	-
Position	Posterior	Mild	Anterior	-

During the last two decades an increasing number of literature addressed the benefit of the use of ultrasound in the labor ward "intrapartum ultrasound: IPUS" due to its availability, simplicity, to decreases the risk of infection with repeated vaginal examination and to add objectiveness to decisions in the labor ward. Though IPUS is not recommended for routine use till no, the International Society of Ultrasound in obstetrics and Gynecology (ISUOG) advised for the its use in prolonged 1<sup>st</sup> or 2<sup>nd</sup> stage of labor to clarify fetal head position and station<sup>[5,6]</sup>.

IPUS can be transabdominal ultrasound (TAUS), transvaginal ultrasound (TVUS) or transperineal ultrasound (TPUS). Among the addressed sonographic measurements in IPUS is the head progression distance (PD) using TPUS that we used in the present study to assess the progress of labor<sup>[7,8]</sup>.

## AIM OF THE WORK

Evaluation of the role of head perineal distance (HPD) using the transperineal ultrasound (TPUS) in assessment of progress of labor

## PATIENTS AND METHODS

This study conducted on 60 cases admitted to El-Shatby Maternity University Hospital in active phase of labor ( $\geq 3$ cm cervical dilatation with uterine contractios), at full term (37-41 weeks) with singleton pregnancy presented by vertex. We exclude cases with maternal comorbidities, antepartum haemorrhage, congenital fetal anomalies and previous uterine surgery. We measured the head progression distance (PD) in each case on admission, after 1 hour and after 2 hours and correlated it with the fetal head station & Bishop score by digital vaginal examination (DVE).

PD was measured using transperineal ultrasound (TPUS) by putting the convex probe sagittally on the perineum (encased by a clean cover and without undue pressure). Then a vertical line drawn from the caudal edge of the symphysis pubis anteriorly to the maternal sacrum

posteriorly (the infrapubic line: IPL). Then a perpendicular line drawn from the IPL to the leading edge of the fetal head, the distance of this line is the head progression distance (PD)<sup>[7]</sup>. We used the convex probe of Midray DP-2200 portable ultrasound machine (3.5-6.5 MHz). We documented also mode of delivery in all cases.

## RESULTS

48 cases (80%) had delivered by spontaneous vaginal delivery and 12 cases (20%) had delivered by cesarean section (CS). The mean Bishop score for those who delivered vaginally was significantly higher than for those who delivered by CS (Tables 2,3, Figure 1). The mean head progression distance (PD) for those who delivered vaginally was significantly longer than for those who delivered by CS (Table 4, Figure 1).

The sensitivity and specificity of Bishop score on admission to predict the mode of delivery was 58.33% and 87.50% respectively at cut-off 7. While for PD, it was 66.67% and 66.67% respectively at cut-off 44mm (Table 5, Figure 2). The sensitivity and specificity of Bishop score after 1 hour to predict mode of delivery was 75% and 81.25% respectively at cut-off 9. While for PD, it was 75% and 68.75% respectively at cut off 51 mm (Table 6, Figure 2). The sensitivity and specificity of Bishop score after 2 hours to predict mode of delivery was 91.67% and 85.71% respectively at cut-off 10. While for PD, it was 91.67% and 78.57% respectively at cut off 63mm (Table 7, Figure 2).

**Table 2:** Comparison between the two studied groups according to Bishop score

Bishop score	Total	Normal delivery	Caesarean delivery	t	P
On admission	(n = 60)	(n = 48)	(n = 12)		
Min. – Max.	6.0 – 11.0	6.0 – 11.0	6.0 – 9.0		
Mean $\pm$ SD.	8.62 $\pm$ 1.39	8.94 $\pm$ 1.28	7.51 $\pm$ 1.07	4.002*	<0.001*
Median	1.39	9.0	7.0		
1 <sup>st</sup> hour	(n = 60)	(n = 48)	(n = 12)		
Min. – Max.	7.0 – 12.0	8.0 – 12.0	7.0 – 10.0		
Mean $\pm$ SD.	9.53 $\pm$ 1.54	10.27 $\pm$ 1.42	8.63 $\pm$ 0.94	4.002*	<0.001*
Median	10.0	10.0	9.0		
2 <sup>nd</sup> hour	(n = 40)	(n = 28)	(n = 12)		
Min. – Max.	8.0 – 13.0	9.0 – 13.0	8.0 – 11.0		
Mean $\pm$ SD.	10.78 $\pm$ 1.14	11.29 $\pm$ 0.81	9.58 $\pm$ 0.90	5.894*	<0.001*
Median	11.0	11.0	10.0		

t: Student t-test. p: p value for comparing between the studied patients. \*: Statistically significant at  $p \leq 0.05$

**Table 3:** Comparison between the two studied groups according to station

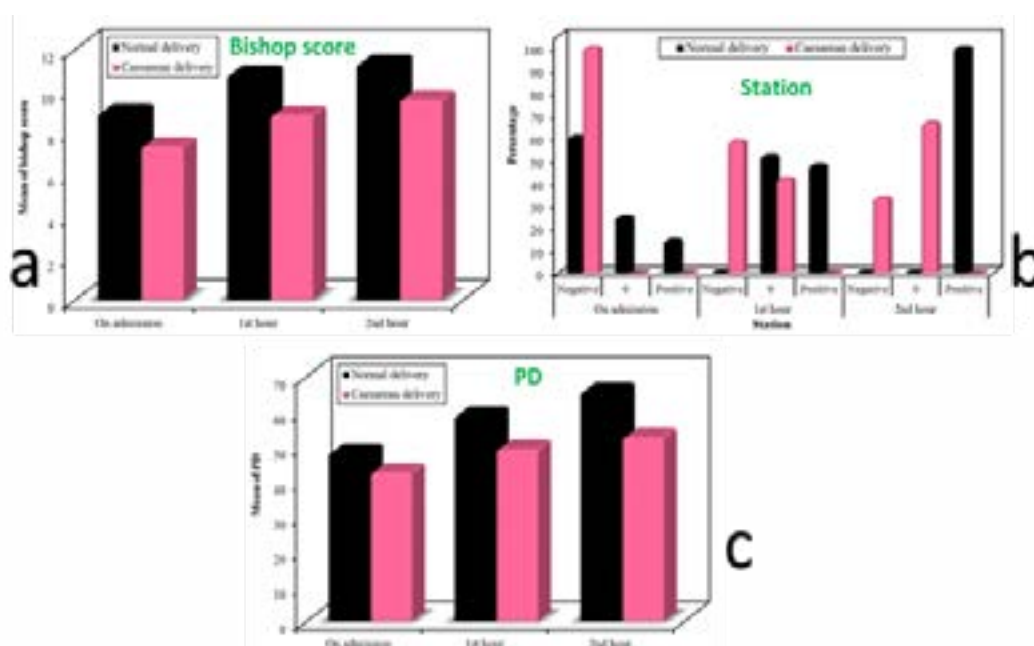
Station	Total (n = 60)		Normal delivery (n = 48)		Caesarean delivery (n = 12)		$\chi^2$	MC <sub>p</sub>
	No.	%	No.	%	No.	%		
On admission	(n = 60)		(n = 48)		(n = 12)		6.294*	0.029*
Negative	41	68.3	29	60.4	12	100.0		
0	12	20.0	12	25.0	0	0.0		
Positive	7	11.7	7	14.6	0	0.0		
1 <sup>st</sup> hour	(n = 60)		(n = 48)		(n = 12)		27.801*	<0.001*
Negative	7	11.7	0	0.0	7	58.3		
0	30	50.0	25	52.1	5	41.7		
Positive	23	38.3	23	47.9	0	0.0		
2 <sup>nd</sup> hour	(n = 40)		(n = 28)		(n = 12)		41.224*	<0.001*
Negative	4	10.0	0	0.0	4	33.3		
0	8	20.0	0	0.0	8	66.7		
Positive	28	70.0	28	100.0	0	0.0		

$\chi^2$ : Chi square test. MC: Monte Carlo. *p*: *p* value for comparing between the studied patients. \*: Statistically significant at  $p \leq 0.05$

**Table 4:** Comparison between the two studied groups according to head progression distance (PD)

Head progression distance (PD) mm	Total (n = 60)	Normal delivery (n = 48)	Caesarean delivery (n = 12)	t	P
On admission	(n = 60)	(n = 48)	(n = 12)		
Min. – Max.	36.0 – 57.0	38.0 – 57.0	36.0 – 50.0	3.381*	0.001*
Mean $\pm$ SD.	47.03 $\pm$ 5.63	48.17 $\pm$ 5.42	42.50 $\pm$ 4.06		
Median	47.0	49.50	41.50		
1 <sup>st</sup> hour	(n = 60)	(n = 48)	(n = 12)		
Min. – Max.	41.0 – 70.0	44.0 – 70.0	41.0 – 56.0	5.339*	<0.001*
Mean $\pm$ SD.	56.87 $\pm$ 8.54	58.77 $\pm$ 8.26	49.25 $\pm$ 4.59		
Median	56.0	59.50	48.50		
2 <sup>nd</sup> hour	(n = 40)	(n = 28)	(n = 12)		
Min. – Max.	48.0 – 80.0	50.0 – 80.0	48.0 – 57.0	6.136*	<0.001*
Mean $\pm$ SD.	61.70 $\pm$ 10.67	65.61 $\pm$ 10.42	52.58 $\pm$ 2.75		
Median	60.0	67.0	52.50		

t: Student t-test. *p*: *p* value for comparing between the studied patients. \*: Statistically significant at  $p \leq 0.05$

**Fig. 1:** Comparison between the two studied groups according to : (a) Bishop score. (b) station. (c) head progression distance (PD)

## HEAD PROGRESSION DISTANCE

**Table 5:** Agreement (sensitivity, specificity) for Bishop score and head progression distance (PD) mm to predict caesarean from normal delivery

On admission	AUC	<i>p</i>	95% C.I		Cut off#	Sensitivity	Specificity	PPV	NPV
			LL	UL					
Bishop score	0.824	0.001*	0.701	0.947	7	58.33	87.50	53.8	89.4
Head progression distance (PD) mm	0.798	0.002*	0.674	0.921	44	66.67	66.67	36.0	91.4

AUC: Area Under a Curve . *p* value: Probability value. CI: Confidence Intervals. NPV: Negative predictive value. PPV: Positive predictive value. \*: Statistically significant at  $p \leq 0.05$ . #Cut off was chosen according to Youden index

**Table 6:** Agreement (sensitivity, specificity) for Bishop score and head progression distance (PD) mm to predict caesarean from normal delivery

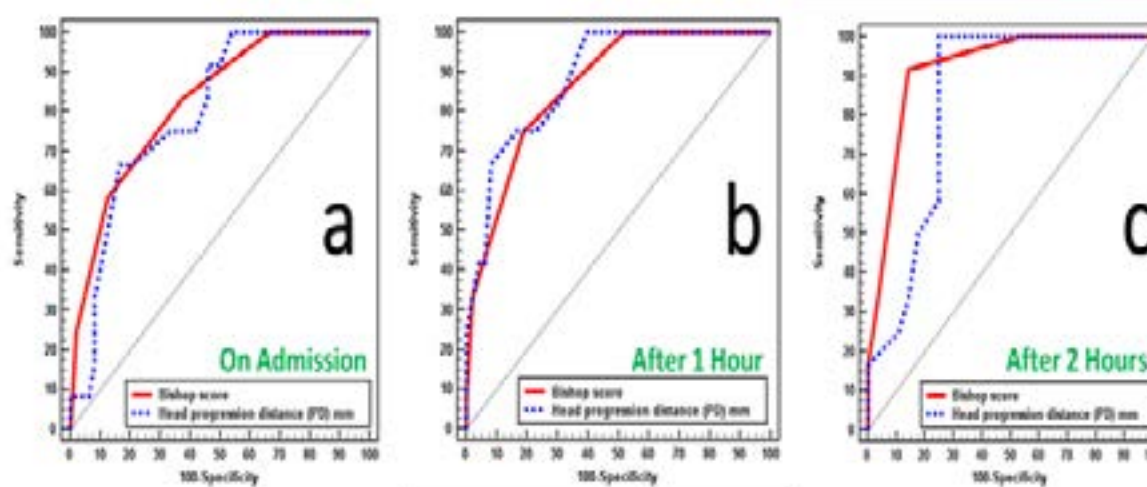
1 <sup>st</sup> hour	AUC	<i>p</i>	95% C.I		Cut off#	Sensitivity	Specificity	PPV	NPV
			LL	UL					
Bishop score	0.865	<0.001*	0.764	0.967	9	75.0	81.25	50.0	92.9
Head progression distance (PD) mm	0.819	<0.001*	0.706	0.931	51	75.0	68.75	34.8	89.2

AUC: Area Under a Curve . *p* value: Probability value. CI: Confidence Intervals. NPV: Negative predictive value. PPV: Positive predictive value. \*: Statistically significant at  $p \leq 0.05$ . #Cut off was chosen according to Youden index

**Table 7:** Agreement (sensitivity, specificity) for Bishop score and head progression distance (PD) mm on the 2nd hour to predict the mode of delivery

2 <sup>nd</sup> hour	AUC	<i>p</i>	95% C.I		Cut off#	Sensitivity	Specificity	PPV	NPV
			LL	UL					
Bishop score	0.917	<0.001*	0.829	1.00	10	91.67	85.71	73.3	96.0
Head progression distance (PD) mm	0.836	0.001*	0.713	0.959	59	75.0	75.0	56.2	87.5

AUC: Area Under a Curve . *p* value: Probability value. CI: Confidence Intervals. NPV: Negative predictive value. PPV: Positive predictive value. \*: Statistically significant at  $p \leq 0.05$ . #Cut off was chosen according to Youden index



**Fig. 2:** ROC curve for Bishop score and head progression distance (PD) mm to predict caesarean from normal delivery: (a) on admission. (b) after 1 hour. (c) after 2 hours.

## DISCUSSION

Progress of labor is assessed by cervical dilatation and head decent. The standard clinical practice is to determine the fetal head station is by digital vaginal examination (DVE). During the last two decades an increasing number of literature addressed the benefit of the use of ultrasound in the labor ward “intrapartum ultrasound: IPUS” due to its availability, simplicity, to decreases the risk of infection with repeated vaginal examination and to add objectiveness to decisions in the labor ward<sup>[1,2,5]</sup>.

Among the addressed ultrasound measurements in IPUS is the head progression distance (PD) using transperineal ultrasound (TPUS) that we used in our study to assess the progress of labor in 60 females in the active phase of labor with singleton pregnancy presented by vertex. We measured the head progression distance (PD) in each case on admission, after 1 hour and after 2 hours (using transperineal ultrasound) and correlated it with the Bishop score by digital examination. We documented also the mode of delivery in all cases.

Our results showed that 48 cases (80%) had delivered by spontaneous vaginal delivery and 12 cases (20%) had delivered by cesarean section (CS). The mean Bishop score for those who delivered vaginally was significantly higher than for those who delivered by CS. The mean head progression distance (PD) for those who delivered vaginally was significantly longer than for those who delivered by CS. The sensitivity and specificity of PD to predict the mode of delivery were comparable to those of Bishop score and fetal head station on admission, after 1 hour and after 2 hours.

Dietz *et al* studied the correlation between head station and the head progression distance (PD) in 139 women not in labor. They found that there were significant association between PD with the fetal head station. This was matched with our findings but our cases were in the 1<sup>st</sup> stage of labor<sup>[7]</sup>.

Erlik *et al* studied the role of PD in 87 nulliparous women in the 1<sup>st</sup> stage of labor. They concluded that there was a statistically significant longer PD in those who delivered vaginally compared to those who delivered by CS for protracted labor. The mean PD at rest in women who delivered vaginally was  $25.1 \pm 17.1$ mm while it was  $14.8 \pm 18$ mm in those who delivered by CS. They also found that the mean PD during maternal pushing in women who delivered vaginally was  $34.3 \pm 18$ mm while it was  $15 \pm 21$ mm in those who delivered by CS. Their findings were comparable to ours<sup>[9]</sup>.

Gilboa *et al* studied the role of PD in 65 cases with prolonged 2<sup>nd</sup> stage of labor. The overall PD was  $65 \pm 13.5$ mm. They found that there was positive correlation

between PD and the fetal head station (which was matching with our findings) but there was no correlation between PD and the mode of delivery (which was in contrary to our findings). Their contrary finding could be explained by two explanations. 1<sup>st</sup>: they studied the PD in the 2<sup>nd</sup> stage of labor but we studied it in the 1<sup>st</sup> stage. 2<sup>nd</sup> explanation is their use of the inrapubic line (IPL) from the lower margin of the echogenic core of the symphysis pubis while we used its hypoechogenic margin (which is a little bit caudal)<sup>[10]</sup>.

## CONCLUSION

Head progression distance (PD) measurement using intrapartum transperineal ultrasound (TPUS) is correlated with Bishop score using digital examination. The increasing PD with progress of labor is associated with more likelihood of vaginal delivery. PD can be used for objective assessment of progress of labor.

## CONFLICT OF INTERESTS

There are no conflicts of interest.

## REFERENCES

1. Crichton D. A reliable method of establishing the level of the fetal head in obstetrics. *S Afr Med J* 1974; 48(18):784-7.
2. McFarlin B, Engstrom J, B Sampson M, Cattledge F. Leopold's Maneuvers. *J Nurse Midwifery* 1985:280- 4.
3. Sik A, Murat B, Serkan K, Eray Ç. Can evaluation of the cervix with histogram and Bishop scoring prior to birth induction forecast the birth type for superannuated primigravidae. *Proceed Obst Gynecol* 2017; 7(1):5.
4. Sciscione AC. Methods of cervical ripening and labor induction: mechanical. *Clin Obstet Gynecol* 2014; 57(2):369-76.
5. Barber MA, Molina FS, Medina M, Romero A, Garcia-Hernandez JA. General Intrapartum Sonography Setup and Use in Labor. In: Malvasi A (ed). *Intrapartum Ultrasonography for Labor Management*: Berlin, Heidelberg: Springer; 2012:15-28.
6. Ghi T, Eggebo T, Lees C, Kalache K, Rozenberg P, Youssef A, *et al*. ISUOG Practice Guidelines: intrapartum ultrasound. *Ultrasound Obstet Gynecol* 2018; 52(1):128-39.
7. Dietz, H.P. and Lanzarone, V. Measuring engagement of the fetal head: validity and reproducibility of a new ultrasound technique. *Ultrasound Obstet Gynecol* 2005; 25: 165-8.

8. Yeo L, Romero R. Sonographic evaluation in the second stage of labor to improve the assessment of labor progress and its outcome. *Ultrasound Obstet Gynecol* 2009; 33:253-8.
9. Erlik U, Weissmann-Brenner A, Kivilevitch Z, Moran O, Kees S, Karp H, *et al.* Head progression distance during the first stage of labor as a predictor for delivery outcome. *J Matern Fetal Neonatal Med* 2018; 1:1-5.
10. Gilboa Y, Spira A, Moran R. Head progression distance in prolonged second stage of labor: relationship with mode of delivery and fetal head station. *Ultrasound Obstet Gynecol* 2013; 41:436-41.