Research Article

The Accuracy of Transvaginal Ultrasound and Bishop Score to Predict the Successful Induction of Labor in Primigravidas at Term

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Abstract |
Objective: To determinethe accuracy of transvaginal ultrasonographic measurement of cervical length versus Bishop Score in predicting success of induction of labor in primigravida presenting at term.
Methods: This comparative cross sectional study was conducted in department of obstetrics and gynecology, Lady Aitchison Hospital, Lahore from January 2015 to July 2015. Total 220 females were included through Non probability, purposive sampling. The females underwent vaginal examination and Bishop Score was noted and case was labeled as positive or negative. Then females underwent Transvaginal Ultrasound (TVS) by researcher herself and the case was labelled negative or positive. Then females were induced by using Misoprostol (PGE1) 50 microgram and were observed for labor onset and normal delivery, All the readings were recorded on specially designed performa. Data was entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 16.0.
Results: The mean age of females was 27.59±7.04 years. The mean gestational age of females at time of presentation was 41.47±0.50 weeks. There were 171 (78%) females who had bishop score >5 while 49 (22%) females had bishop score <5. There were 154 (70%) females who had cervical length <27mm while 66 (30%) females had cervical length >27mm.The mean induction to delivery interval was 23.01±4.66hours. There were 130 (59%) females who delivered within 24 hours while 90 (41%) females who delivered after 24 hours. The calculated sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and diagnostic accuracy of Bishop score were 83.8%, 31.1%, 63.7%, 57.1% and 62.3%.The calculated sensitivity, specificity, PPV, NPV and diagnostic accuracy of cervical length were 90%, 58.9%, 76% ,80,3% and 77.3%.
Conclusion: It was concluded through results of this study that assessment of cervical length on transvaginal ultrasound has more accuracy than bishop in predicting successful induction of labor in primigravidas presenting at term,

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Introduction

Induction of labor is most fruitful when cervix is 'ripe' at that time. It is the process by which cervix undergoes modification in consistency before the onset of labor.[1,2] Labor inductions have gradually increased over the last two decades with rates in many countries now in excess of 20 % of all the births.[3] Almost 20 % of the inductions end up in cesarean section.[4] The most common methods used for cervical assessment before induction of labor are Bishop Score and the transvaginal ultrasound for

measuring cervical length.

A bishop's score is used to determine whether a woman is ready to have a successful vaginal delivery and if labor can be induced. Bishop's Score comprises of station, dilation, effacement, position and consistency. Station is a term used to describe the descent of the fetus into the pelvis.[5] Dilation is measured in centimeters, from 0 to 10. Effacement is the thinning of the cervix. When the cervix is 100% effaced it is softened out completely and female is ready for normal delivery.

Before 28 weeks of pregnancy, cervical length by transvaginal ultrasound below the 10th percentile (25 mm) is almost always associated with an increased risk of onset of preterm birth. Ultrasound imaging of the cervix throughout gestation has clarified cervical changes during pregnancy. Cervical effacement is one of the first steps in the childbirth process, beginning about four to eight weeks before labor. Effacement begins at the internal cervical os and moves caudally in a gradual fashion, so it can be visualized on ultrasound, but is not always assessed accurately digitally or visually. As cervix shortens in the second trimester, the chances of preterm birth increase, especially when effacement starts in the early second trimester.[6]

Digital assessment of cervix at vaginal examination is not objective and is subject to bias. Sonographic evaluation of cervical length can be helpful in predicting successful labor outcome. Transvaginal ultrasonography (TVS) is a time tested method for assessing the entire length and various features of the internal os even when the external os is closed.[7] According to a study by Maitra and colleagues, if the cervical length is less than 3 cm on TVS, the probability of cesarean section was less than 30% and with cervical length of 4 cm, the probability became more than 75%.[8] In a study conducted by Vrouenraets, Bishop Score of 5 or less was associated with increased risk of cesarean section.[9] Bishop score may be less effective to anticipate success of induction of labor. But the practice of bishop score should not be shunned, as it helps to judge whether the cervix is ripe or next doses of prostaglandins are required to achieve ripeness. However, when used alone to determine the outcome of induction of labor, the bishop score does not fulfill standards for an effective diagnostic tool. According to upcoming evidence transvaginal ultrasonography is superior in cervical length assessment in comparison to digital examination.[10]

Obstetricians are using bishop score in routine to determine whether female will go in normal labor or not. Literature also bears testimony that it is not a good option as compared to newly developed technique like TVS but some ambiguity exists in results showing high accuracy rate of bishop scoring as compared to TVS. Rationale of this study was to compare the accuracy of transvaginal ultrasound with bishop score for cervical length assessment to determine the best method for successful induction of labor in primigravidas at term. This in turn would decrease the alarming rate of cesarean section.

Patients And Methods

It was a comparative cross sectional study conducted at Unit IV, Department of Obstetrics and Gynecology, Lady Atchison Hospital, Lahore from January 2015 to July 2015. A Sample size of 220 patients was estimated using 95% confidence interval, 7% margin of error for 59% sensitivity[8], 9% margin of error for 78% specificity[8] of TVS with an expected frequen-cy of successful induction in 74% of cases. Non probability, purposive sampling technique was used.

Primigravidas of age 18-40 years at 41 completed weeks of gestation (on LMP) with singleton cephalic pregnancy were included in the study. Those having multiple pregnancy (on USG), females with non-cephalic presentation (on USG), patients with Premature Prolonged Rupture of the Membrane/Premature Rupture of Membrane (PPROM-/PROM) (on per speculum examination), High risk pregnancies like Pregnancy Induced Hypertension (PIH) (BP>140/90mmHg), pre-eclampsia (PIH with +1 proteinurea on dipstick) or eclampsia (pre-eclampsia with convulsions) or gestational diabetes (BSR>200gm/dl) were excluded from the study.

After taking consent from hospital ethical committee, 220 females fulfilling the inclusion criteria admitted in labor room of department of Obstetrics & Gynecology Lady Aitchison Hospital, Lahore were included. Patients were informed about the merits and demerits of study and their verbal consent was taken.

Demographic information (name, age, gestational age, contact) were also obtained. Then females underwent vaginal examination and bishop score was noted and case was labeled as positive or negative (as per operational definition). Then females underwent TVS by researcher herself. The women were examined in dorsal lithotomy position with an empty urinary bladder. A sagittal plane through cervix was identified when the external cervical os, cervical canal and internal cervical os were visible and cervical length was measured by taking distance between internal cervical os and external cervical os and case was labeled as positive or negative (as per operational definitions).

Cervical length: cervical length is the distance between internal and external cervical os. Induction of labor: Giving Misoprostol (PGE1) vaginally to every patient in study for induction of labor at 41 completed weeks is induction. On TVS cervical length ≤27 mm was taken as positive. On TVS cervical length >27 mm was taken as positive. Success of induction on TVS was defined as vaginal delivery achieved in 24 hours as predicted by TVS (length≤27mm). Bishop Score ≥ 5 was taken as positive. Bishop score < 5 was taken as negative.

Success of induction on Bishop Score was defined as vaginal delivery achieved in 24 hours as predicted by bishop score (bishop score≥5)

All the females were induced with Tab Misoprostol 50 microgram as per the hospital protocol and waited for labor to start and normal delivery to occur. If required the dose of Misoprostol was repeated for the second time after 6 hours. Cardiotocography (CTG) was used to monitor fetal heart rate. All the details were noted on a specially designed performa.

Data was entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 16.0. Mean and standard deviation was calculated for quantitative variables like age, gestational age, bishop score and cervical length. Frequency and percentage was calculated for successful induction of labor. 2x2 table was generated to calculated sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and diagnostic accuracy of TVS and Bishop score taking successful induction (delivery occurs within 24 hours) as gold standard.

Results

There were 220 females included in this study with no drop out. The mean age of 27.59±7.04 years. The minimum age of females was 18 years while maximum age was 40 years.

The mean gestational age of females at time of presentation was 41.47±0.50weeks. The minimum gestational age of females was 41 weeks while maximum gestational age was 42 weeks.

The mean bishop score and cervical length of females after induction were calculated (Table 1).

There were 171 females who had bishop score >5 while 49 females had bishop score <5. (Figure 1)

There were 154 females who had cervical length <27mm while 66 females had cervical length >27mm (Figure 2).

The mean induction to delivery interval was 23.01±4.66 hours. The minimum induction to delivery interval was 14 hours while maximum induction to delivery interval was 39 hours. Distribution of Induction to delivery interval was calculated (Figure 3).

There were 130 (59%) females who achieved success, out of which 109 (83.8%) were positive for bishop score (>5) while 21 (16.2%) had negative bishop score (<5). Among 90 (41%) females who could not achieved success, 62 (68.9%) had positive for bishop score (>5) while 28 (31.1%) had negative bishop score (<5).There were 130 (59%) females who achieved success, out of which 117 (90.0%) had cervical length <27mm while 13 (10.0%) had cervical length >27mm. Among 90 (41%) females who could not achieved success, 37 (41.1%) had cervical length <27mm while 53 (58.9%) had cervical length >27mm (Table 2).

The predictive values for Bishop Score and Cervical Length were tabulated (Table 3).

Table 1: *Mean Score of Total Study Group*

Variable	Mean ±SD
Bishop Score	6.78±2.66
Cervical Length (TVS)	26.40±3.69 mm

Table 2: *Comparison of Success (delivery within 24 hours) Bishop Score vs. Cervical Lengthy*

		Success		
		Yes	No	Total
Bishop ≥5	Yes	109 (83.8%)	62 (68.9%)	171 (77.7%)
	No	21 (16.2%)	28 (31.1%)	49 (22.3%)
Total		130 (100%)	90 (100%)	220 (100%)
Cervical Length (<27mm)	Yes	117 (90.0%)	37 (41.1%)	154 (70.0%)
	No	13 (10.0%)	53 (58.9%)	66 (30.0%)
Total		130 (100%)	90 (100%)	220 (100%)

Table 3: *Comparison of Predictive Values (Bishop Score vs. Cervical Length)*

Variable	Sensitivity	Specificity	PPV	NPV	Diagnostic Accuracy
Bishop Score ≥5	83.8	31.1	63.7	57.1	62.3
(TVS) Cervical Length≤ 2.7 cm	90 %	58.9 %	76 %	80.3 %	7.3 %

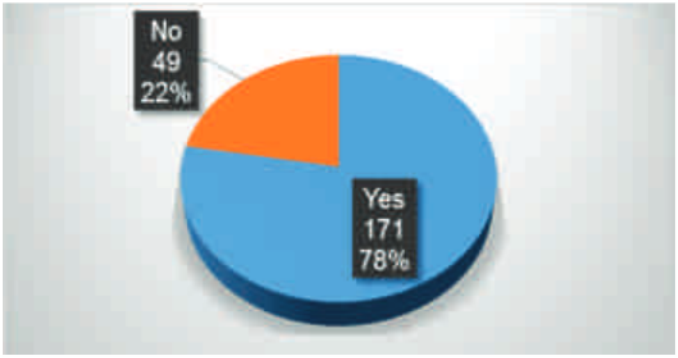

Figure 1: *Distribution of Positive Bishop Score (>5)*

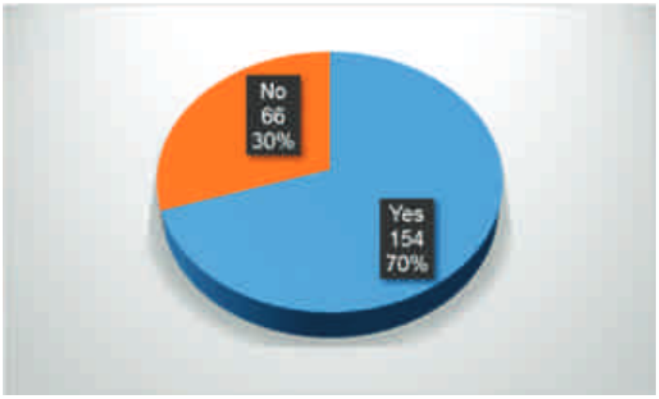

Figure 2: *Distribution of Positive Cervical Length (<27mm)*

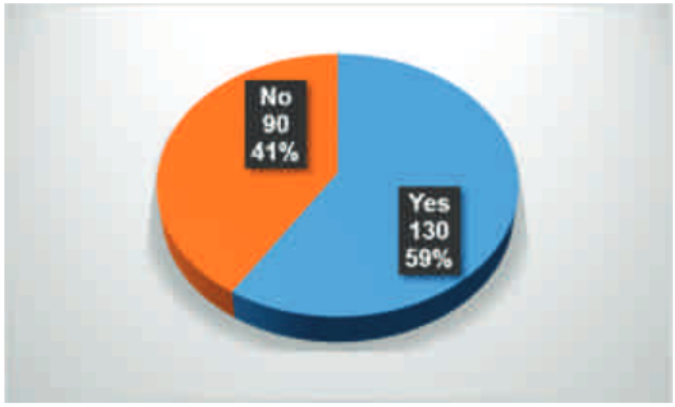

Figure 3: *Distribution of Induction to Delivery Interval <24 hours*

Discussion

Induction of labor is a process where the uterine contractions are artificially started by medical or surgical means before the spontaneous onset of labor, and the most common indications for induction of labor are prolonged pregnancy, PROM or medical disorders in pregnancy.[11,12]

It has been observed that 18% of the patients undergoing induction of labor need a cesarean section, thus there is a dire need for finding accurate methods for the prediction of successful induction of labor.[13,14]

One of the most common labor ward problems is the difference of digital assessment of the cervix between the doctors. This is mainly due to the subjective nature of the assessment of the cervical length.[15]

The main reason for cervical assessment before induction of labor is the choice of inducing agent, which may decide the duration of labor and the outcome.[16] In 1964; Bishop devised a cervical scoring system called the bishop's score. It has a poor predictive value for the outcome of induction of labor because of the interobserver variation in the assessment of the cervical condition.[17,18]

Thus we conducted a cross sectional survey to find out an accurate method for cervical assessment in primigravidas planned to undergo induction. There are no local studies on the subject.

Thus in our study, the calculated sensitivity, specificity, PPV, NPV and diagnostic accuracy of bishop Score for successful induction (delivery within 24 hours) were 83.8%, 31.1%, 63.7%, 57.1% and 62.3%

while the calculated sensitivity, specificity, PPV, NPV and diagnostic accuracy of cervical length for successful induction (delivery within 24 hours) were 90.0%, 58.9%, 76.0%, 80.3% and 77.3%. The accuracy of cervical length assessment is higher than that of bishop score in predicting success of induction of labor in primigravidas at term.

Most of the research done in the present times matches our results. In a recent study conducted by Bajpai, labor induction was successful in 86.9% of patients. At cut off Scores of ≥4, TVS cervical Score showed better results than bishop score (Sensitivity 77% vs. 65%, Specificity 93% vs. 86%).[19] Gouri et al also concluded that among the women with bishop score≤5, 62.5% of women had vaginal delivery within 24 hours. In women with bishop score> 5, 78.5% had successful induction. When cervical length is considered, among the women with cervical length > 2.8cm, 48.9% had successful induction, whereas in women with cervical length ≤ 2.8 cm 84% had successful induction.[20] In another two recent studies conducted by Shekhawat and Ibrahim cervical length by TVS is useful and independent predictor of successful labor induction. When CL < 3.5 cm, 88% (66/75) delivered vaginally and when CL > 3.5 cm only 11.42% (4/35) delivered vaginally.[21,22] Study by Kahlia and colleagues almost showed similar results.[23]

There are also other studies whose results do not match our results. In a study by park the rates of induction success and cesarean delivery, the interval to active phase of labor and the interval to delivery were also similar in the two groups.[24] Another study reported that TVS has sensitivity of 59% and specificity of 78% only while the Bishop's score had a sensitivity of 65% and specificity of 78% which concluded that TVS evaluation of the cervix before induction of labor does not improve the prediction of cervical inducibility obtained by the BS.[25]

In a new study conducted by Ranjana Atal and colleagues we found that TVS measurement of cervical length is a better predictor of successful labor induction in terms of delivery.[26]

The strength of this study is that it has been conducted on a subject which has not been studied much in our setup. The results of this study will help in reducing the cases of failed induction and hence the rate of cesarean section. On the other hand this study has been carried out on a small period with small sample size. Only primigravidas have been the focus of this research.

Conclusion

It was concluded through results of this study that assessment of cervical length by transvaginal ultrasound has more accuracy than bishop in primigravidas presenting at term for induction of labor to prevent undue Cesarean Sections. Thus we resolved a prevailing controversy and found cervical length assessment to be more beneficial as compared to bishop score. Now in future we will implement the use of TVS for assessment of cervical length.

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References

1. Norman JE. Induction and Augmentation of Labour: Dewhurst's Textbook of Obstetrics & Gynaecology. New Jersey: Wiley-Blackwell; 2012.
2. Maitra N, Sharma D, Agarwal S. Transvaginal measurement of cervical length in the prediction of successful induction of labour. J Obstet Gynaecol. 2009;29(5):388-91.
3. Chauhan SP, Ananth CV. Induction of labor in United States: A critical appraisal of appropriatness and reducibility. Semin Perinatol. 2012; 36:336-43.
4. G Deepika, A Kumar, R Sood, A Sood. Prospective evaluation of clinical andultrasonicfeto-maternal parameters as predictors of caesarean delivery after induction of labour. Biomed Res Int[Online]. 2014; 5(1): 264-67.
5. Laughon KS, Zhang J, Troendle J, Sun L, Uma M,Reddy UM. Using a simplified Bishop score to predict vaginal delivery. Obstet and Gynecol. 2011; 117(4):805-811.
6. Hernandez-Andrade E, Romero R, Ahn H, Hussein Y, Yeo L, Korzeniewski SJ, et al. Transabdominal evaluation of uterine cervical length during pregnancy fails to identify a substantial number of women with a short cervix. J Matern Fetal Neonatal Med. 2012 Sep;25(9):1682-9.
7. Hatfield AS, Sanchez-Ramos L, Kaunitz AM. Sonographic cervical assessment to predict the success of labor induction: a systematic review with metaanalysis. Am J Obstet Gynecol. 2007; 197(2): 186-92s.
8. Maitra N, Sharma D, Agarwal S. Transvaginal measurement of cevical length in prediction of succesful induction of labour. J Obstet Gynecol 2009; 29(5):388-91.
9. Vrouenraets FP, Roumen FJ, Dehing CJ et al. Obstet Gynecol.2005;105(4):690-7.
10. Cubal A, Carvalho J, Ferreira MJ, Rodrigues G,

Carmo OD. Value of Bishop Score and ultrasound cervical length measurement in the prediction of cesarean delivery. J ObstetGynaecol Res. 2013; 39(9): 1391-96.

11. Caughey AB. Post-term pregnancy. In: Emonds K, editor. Dewhurst's Textbook of Obstetrics and Gynaecology. London: Blackwell Science; 2012.
12. Bennett KA, Crane JM, O'Shea P, Lacelle J, Hutchens D, Copel JA. First trimester ultrasound screening is effective in reducing postterm labor induction rates: a randomized controlled trial. Am J Obstet Gynecol. 2004;190(4):1077-81.
13. Norwitz E, Robinson J, Repke J. Labor and delivery. In: Gabbe SG, Niebyl JR, Simpson JL, editors. Obstetrics: Normal and Problem Pregnan-cies. 4th ed. New York: WB Saunders Company; 2001: 353-394.
14. Pandis G, Papageorghiou A, Ramanathan V, Thompson M, Nicolaides K. Preinduction sono-graphic measurement of cervical length in the prediction of successful induction of labor. Ultra-sound in obstetrics & gynecology. 2001;18(6):623-8.
15. Caliskan E, Bodur H, Ozeren S, Corakci A, Ozkan S, Yucesoy I. Misoprostol 50 µg sublingually versus vaginally for labor induction at term: a randomized study. Gynecologic and obstetric investigation. 2005; 59(3): 155-61.
16. Jackson GM, Ludmir J, Bader TJ. The accuracy of digital examination andultrasound in the evaluation of cervical length. Obstetrics & Gynecology. 1992; 79(2): 214-8.
17. 93. Bartha J, Romero-Carmona R, Martínez-del-Fresno P, Comino-Delgado R. Bishop score and transvaginal ultrasound for preinduction cervical assessment: a randomized clinical trial. Ultrasound Obstet Gynecol. 2005;25(2):155-9.
18. Hughey MJ, McElin TW, Bird CC. An evaluation of preinduction scoring systems. Obstetrics & Gynecology. 1976;48(6):635-41.
19. Bajpai N, Bhaktar, Kumar P, Rai L, Habbar S. Manipal Cervical Scoring System by Transvaginal Ultrasound in Predicting Successful Labour Induction. J Clin Diagn Res. 2015 ; 9(5):4-9.
20. S.R.Sree Gouri, T.Jyothirmayi, B.Varalakshmi. Role of Bishop score and cervical length by transvaginal-ultrasound in induction of labour in primigravidae IOSR-JDMS. 2015; 14(8):81-85.
21. Shekhawat Nitesh Kanwar, Pant Reena, Banerjee Krishna Priya:A Comparative Study of Trans vaginal Sonography and Modified Bishop's Score for Cervical Assessment before Induction of LabourSch. J App Med Sci. 2015; 3(6B):2284-2288.
22. Ibrahim A. Abdelazim, Mohannad Lutfi Abu faza. Sonographic assessment of the cervical length before induction of labor. Asian Pac J Reprod. 2012; 1(4):253-257
23. Kehila M, Bougmiza I, Ben Hmid R, Abdelfattah W, Mahjoub S, Channoufi MB. Bishop score vs. ultrasound cervical length in the prediction of cervical ripening success and vaginal delivery in nulliparous women. Minerva Ginecol. 2015; 67(6) 499-505.
24. Park KH, Kim SN, Lee SY, Jeong EH, Jung HJ, Oh KJ. Comparison between sonographic cervical length and Bishop score in preinduction cervical assessment: a randomized trial. Ultrasound Obstet Gyneacol. 2011; 38(2):198-204.
25. Gonen R, Degani S, Ron A. Prediction of successful induction of labor: comparison of transvaginal ultrasonography and the Bishop score. Eur J Ultrasound. 1998;7(3):183-7.
26. Ranjana A, Jyoti M, Chauhan M. Study on comparison of transvaginal cervical length and Bishop Score in predicting succesful labour induction. Inter J Curr Trends Sci Tech. 2016;18(1):181-184.