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Original Article

Comparative Analysis of Trans Vaginal Ultrasound and Bishop Score For Successful Prediction of Induction of Labor in Term Primigravidas

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ABSTRACT

Successful prediction of labor induction outcomes in the term primigravidas has significant implications for maternal and neonatal health. **Objective:** To compare trans vaginal ultrasound (TVS) and bishop score for successful prediction of induction of labor in term primigravidas. **Methods:** This cross sectional comparative study was carried out at Department of Gynecology and Obstetrics and Department of Radiology of Shahida Islam Medial Complex, Lodhran, Pakistan using non-probability purposive sampling technique. The duration of study was six months from October 2023 to March 2024. Booked primigravidas in-between 18 to 40 years at 37-40 gestational week having singleton pregnancy were included Each female underwent Bishop scoring and TVS ultrasound **Results:** From total 151 pregnant females mean age was 28.63 ± 8.12 years, mean gestational age was 40.24 ± 0.77 weeks, mean bishop score and mean cervical length measured by TVS was 6.95 ± 2.21 and 27.2 ± 3.98 mm respectively. 117 (77.48 %) females had positive Bishop Score, 106 (70.2 %) positive Cervical Length (>27 mm) and 90 (59.6 %) induction of labor. Diagnostic accuracy of Bishop Score was 65.9 % while for TVS ultrasound was 80.2 %. Significant difference of p<0.001 was reported in-between cervical length >27 mm on TVS and successful induction of labor. TVS showed higher sensitivity 89.7%, specificity 62.3%, positive predictive value 77% and negative predictive value 82.1% as compared to Bishop Score. **Conclusions:** The results of this study concluded that the assessment of cervical length on TVUS was more accurate than Bishop Score in predicting successful induction of labor in term primigravidas.

INTRODUCTION

Labor induction is one of the frequent obstetrical interventions aimed at initiating uterine contractions to achieve vaginal delivery in cases where continuation of pregnancy poses risks to maternal or fetal health [1]. Labor induction rates have been steadily increasing globally, reflecting changes in obstetric practices, maternal demographics, and medical indications [2]. Indications for labor induction include post-term pregnancy, preeclampsia, fetal growth restriction, gestational diabetes, and maternal medical conditions such as hypertension or renal disease [3]. Successful labor induction relies on the readiness of the cervix, characterized by cervical ripeness and effacement, to respond to oxytocin or prostaglandin administration [4]. Effectively predicting labor induction successfully is crucial for optimizing obstetric outcomes and minimizing the need for cesarean delivery [5]. In primigravida at term, several techniques are employed to assess readiness of cervix for induction, including Trans-Vaginal Ultrasound (TVUS) and the Bishop score [6]. TVUS offers a non-invasive method for assessing cervical length, position, and morphology, providing valuable information on cervical ripeness and predicts likelihood of successful induction of labor [7]. TVUS measures cervical length from the external

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os to the internal os and evaluates cervical consistency, dilatation, and effacement. A shorter cervical length and increased cervical dilatation and effacement on TVUS are associated with a higher likelihood of labor's spontaneous onset with successful induction [8]. The Bishop score is a widely used clinical score to assess readiness of cervix for labor induction, comprising five components: cervical dilatation, effacement, consistency, position, and fetal station [9]. Each component is assigned a score ranging from 0 to 3 or 0 to 2, with higher scores indicating favorable cervical conditions for induction. The total Bishop score provides an overall assessment of cervical readiness, with scores ≥ 5 considered favorable for successful labor induction [10]. Successful prediction of labor induction outcomes in term primigravidas has significant implications for maternal and neonatal health, healthcare resource utilization, and patient satisfaction [11]. While both TVUS and the Bishop score are established methods for assessing cervical readiness, limited research has directly compared their predictive accuracy and clinical utility, particularly in term primigravidas [12]. Understanding the comparative performance of these two approaches can inform evidence-based decision-making in clinical practice and optimize the management of labor induction in this population [13]. By elucidating the comparative performance of TVUS and the Bishop score, this research can inform evidence-based obstetric practice, optimize resource allocation, and improve maternal-fetal outcomes in this high-risk population [14]. Additionally, identifying the most reliable predictor of successful labor induction may facilitate personalized approaches to obstetric care and enhance patient counseling and decision-making regarding labor management strategies [15].

This study hypothesized that Trans Vaginal Ultrasound (TVS) is more accurate than the Bishop Score in predicting the successful induction of labor in term primigravidas. By conducting a comparison of TVUS and the Bishop score, this research seeks to identify the most reliable predictor of successful labor induction and guide individualized patient care.

METHODS

A comparative cross sectional study was carried out at Department of Gynecology and Obstetrics and Department of Radiology of Shahida Islam Medical Complex, Lodhran, Pakistan using non-probability purposive sampling. The study was carried after obtaining Institutional review board No. SIMC/H.R./7726/23. Study duration was six months from October 2023 to March 2024. Using open epi online software for sample size calculation, keeping 74 % as the expected frequency of successful induction of labor as reported in a study, the sample size came out to be 151 at 95 % confidence level [16]. Booked primigravidas in-between 18 to 40 years of age at around 37-40 gestational week (from LMP) having singleton pregnancy (cephalic) were included in the study. Booked primigravidas were chosen to reduce variability caused by previous childbirths and ensuring homogenous population. The age of 18 to 40 years was chosen as this is the reproductive child age group years and gestational age of 37 to 40 weeks was chosen to ensure focus on full-term pregnancies standardizing the gestational timeframe, ensuring that all participants are at a comparable stage of pregnancy, which is critical for assessing the effectiveness of induction methods. Limiting the study to singleton pregnancies eliminates the increased risks and different management protocols associated with multiple gestations, allowing for a more straightforward comparison between TVS and Bishop Score. In females with multiple pregnancies as reported by ultrasonography (USG), females with premature rupture of membrane or premature prolonged rupture of membrane (PROM or PPROM) on clinical examination, high risk pregnancy such as gestational diabetes (blood glucose >200 mg/dl), pregnancy induced hypertension (PIH) with blood pressure >140/90 mmHg, pre-eclampsia or eclampsia were excluded from the study due to additional monitoring and interventions that could skew the results. Excluding multiple pregnancies ensures the study focuses on standard induction protocols without the additional complexities and risks associated with multiple gestations. PROM or PPROM can significantly alter the approach to labor induction and the natural progression of labor, confounding the study results. Informed consent was sought from every female prior to inclusion. Complete medical and surgical history including demographics, general physical and clinical examination was included in the study. During clinical examination, each pregnant female underwent bishop scoring and vaginal examination and were labeled as negative or positive according to operational definition. Thereafter, trans-vaginal ultrasound (TVS) was performed by the researcher themselves using a high-resolution transvaginal ultrasound machine (LOGIQ S6, General Electrical, Japan) equipped with a 5-9 MHz transducer probe. The ultrasound machine was equipped with advanced obstetric software for precise measurements of cervical length and detection of cervical funneling. A high-frequency transvaginal transducer probe was used to provide detailed imaging of the cervix. This probe allows for close proximity imaging, resulting in high-resolution images critical for accurate measurements. Examination was conducted with the pregnant female in dorsal lithotomy position having empty bladder. Sagittal plane through cervix was determined when external os, cervical canal and internal os were visible and length of cervix was calculated measuring distance in-between internal and external os, thereafter being labeled positive or negative. Cervical length was defined as distance in-between internal and external os while induction of labor was defined as administration of misoprostol drug per vaginum in each pregnant female for

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inducing labor at 40 weeks gestation. Using TVS ultrasound, a cervical length of >27 mm was considered as positive. Successful induction of labor on TVS was termed when vaginal delivery was carried out within 24 hours as TVS predicted (at >27 mm length). A Bishop score of >5 was considered as positive while <5 as negative. For induction of labor, all pregnant females were administered 50 mcg of Misoprostol as per protocol of the hospital and waited. If induction did not pursue, dose was repeated at six hours. To monitor fetal heart rate, Cardiotocography (CTG) was used. All the information was recorded with confidentiality. For analysis of data, SPSS version 23.0 was used. Quantitative variables were presented as, mean and standard deviation (maternal and gestational age, cervical length and bishop scores). For categorical variables such as successfl labor induction, specificity, sensitivity, Positive and Negative Predictive Value (PPV and NPV) and diagnostic accuracy of TVS and bishop scoring, frequency and percentage were reported. Chi square test was applied between accuracy of TVS and bishop scoring, keeping p value <0.05 of statistical significance.

RESULTS

Total 151 pregnant females were enrolled with mean age of 28.63 ± 8.12 years. Mean gestational age was 40.24 ± 0.77 weeks at time of presentation. The mean bishop score and cervical length by TVS was 6.95 ± 2.21 and 27.2 ± 3.98 mm respectively. Total of 90 females achieved success, from which 75 (83.3 %) were positive for >5 Bishop Score. Amongst 62 females without successful induction, positive Bishop Score was observed in 43 (69.3 %) females. A significant difference of <0.03 was observed between Bishop Score and successful induction of labor. This suggests that a higher Bishop Score is associated with a higher likelihood of successful labor induction, although the association is moderate. In 90 females with successful induction of labor, 81 (90 %) had >27 mm of cervical length and in 62 females without successful induction of labor, 25 (40.3 %) had cervical length of >27 mm on TVS. Significant difference of p<0.001 was reported in-between cervical length >27 mm on TVS and successful induction of labor as shown in table 1. This indicates that a cervical length greater than 27 mm is strongly associated with successful labor induction. The data shows that both the Bishop Score and cervical length measured by TVS are useful predictors of successful labor induction in term primigravidas. However, cervical length appears to be a stronger and more reliable predictor compared to the Bishop Score.

Table 1: Comparison of Bishop Score and Cervical Length on TVS Success Rate for Induction of Labor (n=151)

Variables		Successful Induction of Labor N (%)		p-Value
		Yes	No	
Bishop Score >5	Yes	75 (83.3 %)	43 (69.3 %)	0.03
	No	15 (16.6 %)	19 (30.6 %)	
Cervical Length >27 mm on TVS	Yes	81 (90 %)	25 (40.3 %)	<0.001
	No	09 (10 %)	37 (59.7 %)	

Predictive values of both Bishop Score and Cervical Length >27 mm on TVS in terms of sensitivity, specificity, PPV, NPV and diagnostic accuracy were recorded in table 2. Cervical length measurement via TVS demonstrates higher sensitivity, specificity, PPV, NPV, and diagnostic accuracy compared to the Bishop Score. This suggests that cervical length > 27 mm on TVS is a more reliable and accurate predictor of successful labor induction in term primigravidas.

Table 2: Comparison of Predictive Values in Terms of Bishop Score versus Cervical Length on TVS (n=151)

Variables	Sensitivity (%)	Specificity (%)	Positive Predictive Value %	Negative Predictive Value %	Diagnostic Accuracy %
Bishop Score >5	86.2%	41%6	67.1%	59%	65.9%
Cervical Length >27 mm on TVS	89.7%	2.3%	77%	82.1%	80.2%

There were 117 (77.48 %) females having positive Bishop Score while 106 (70.2 %) had positive Cervical Length and 90 (59.6 %) had induction of labor as shown in figure 1.

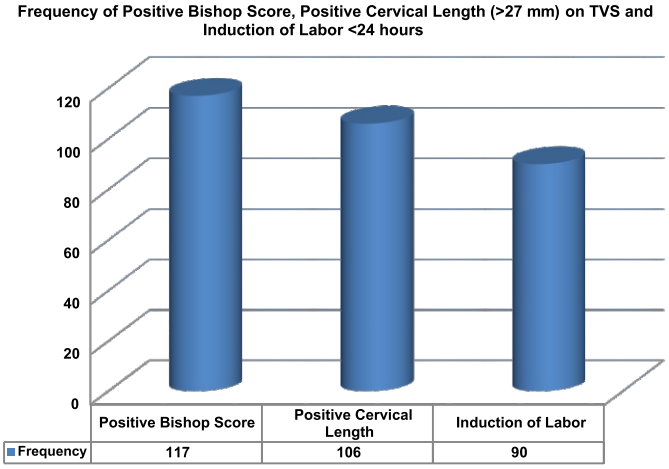

Figure 1: Graphical representation of Positive Bishop Score, Positive Cervical Length (>27 mm) on TVS and Induction of Labor <24 hours (n=151)

DISCUSSION

The results of this study showed that although both TVUS and Bishop Score were successful in prediction of labor induction, TVUS was observed to be a far better predictor. In terms of sensitivity (89.7 % vs 86.2 %), specificity (62.3 % vs 41 %), PPV (77 % vs 67.1 %) and NPV (82.1 vs 59 %) as well as diagnostic accuracy (80.2 % vs 65.9 %), TVUS was reported to be better suited in prediction of labor induction successfully in term primigravidas. TVS and the Bishop score are commonly used methods for predicting the labor induction in primigravidas at term successfully [17]. The Bishop score, which evaluates cervical consistency, dilation, position, effacement and presenting part's station, has been widely used as a standard method for

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assessing cervical ripeness. However, its subjectivity and high intra and inter observer variability have caused searching for a more objectively sound method of assessment [18, 19]. Several studies have assessed predictive values of cervical measurements measured via TVS. In accordance with our research, a pilot study found that trans-vaginal ultrasound of cervix prior to labor induction was better a predicting effective induction as compared to Bishop score [20]. Another research similar to ours reported that women that were scheduled for labor induction reported assessment through digital examination of cervix and trans-vaginal ultra-sonographic of cervix more accurate in predicting cervical inducibility than the Bishop score [21]. Likewise a more recent study of 131 women found that trans-vaginal ultrasonography of length of cervix was much accurate and objective compared to Bishop Score in prediction of likelihood of successful labor induction. The study found that specificity and sensitivity, positive and negative predictive values were much more based on length of cervix 27 mm when compared with bishop score (> 5) [22]. Another comparative study, similar to our research, cervical TVS and Bishop score in predicting effective labor induction found that trans-vaginal ultrasonography, with its ability to objectively measure cervical parameters, could possibly be able to give better way for prediction [23]. The research concluded that cervical TVS score, which comprises of 5; cervical length and position, distance from presenting part to external os and funneling at internal os performed better compared with the Bishop score in prediction [24]. In addition to cervical length, other parameters such as distance from the presenting part to the external os, funnel length and width at internal os and position of cervix have been found to be important predictors of successful induction [25]. A research showed cervical length, presence of funneling, parity and Bishop Score were significantly termed as independently predicting of labor induction successfully [26]. The study population was restricted to low-risk, term primigravidas with singleton, cephalic pregnancies, which may limit the generalizability of the results to other obstetric populations, such as multiparous women, those with high-risk pregnancies, or those with non-cephalic presentations. Additionally, the cost-effectiveness and feasibility of implementing TVS in routine clinical practice need to be evaluated. Finally, long-term maternal and neonatal outcomes should be studied to understand the broader implications of using TVS for labor induction prediction.

CONCLUSIONS

In conclusion, there was moderate association between higher Bishop Score and likelihood of successful induction of labor. However TVS cervical score, which includes objective measurements of cervical parameters, has been found to be a more accurate and objective method of predicting successful labor induction in primigravidas at term compared to the Bishop score. The positive and negative predictive values of cervical length, diagnostic accuracy, sensitivity and specificity on TVS were found to be superior as compared to Bishop Scoring. Nonetheless, further researches are required for confirming such findings and to determine optimal cut-off values for predicting successful induction.

Authors Contribution

Conceptualization: WA

Methodology: NM

Formal analysis: SB

Writing, review and editing: WA, NM, FU, SB, ZUA

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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