Measurement of the Cervical Length in the Prediction of Successful Induction of Labor

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Abstract

Objective: To compare the clinical value of transvaginal ultrasonographic cervical length measurement and Bishop score in predicting the success of labor induction in pregnancies with unfavorable cervix.

Methods: The study was conducted prospectively in 173 term pregnancies who required medical labor induction for various indications. Inclusion criteria were singleton pregnancy, vertex presentation, gestational age >37 weeks, Bishop score <=4 and intact fetal membranes. Cervical length measurement with transvaginal ultrasonography and assessment of Bishop score was performed before induction. All women without risk factors or contraindications for vaginal delivery had either 25 or 50µg vaginal misoprostol for every 6 hours. The mode of delivery, vaginal delivery in 24 hours, induction to delivery and induction to active phase intervals were our primary outcomes. Logistic Regression analysis and receiver-operating characteristics curves were used to determine the value and effectiveness of Bishop score and cervical length in predicting the success of induction.

Results: The mean cervical length and Bishop score were 30.90±6.63mm, and 2.84±1.88 respectively. Hundred and twenty one (69.9%) women delivered vaginally. Logistic regression analysis demonstrated that cervical length and having at least one vaginal delivery provided significant independent variables in prediction of vaginal delivery (p=0.0101; p=0.0332). However receiver-operating characteristics curves demonstrated that cervical length was not beter than Bishop score in predicting the mode of delivery.

Conclusion: Preinduction transvaginal ultrasonographic of cervical length measurement and having at least one vaginal delivery are independent variables in predicting the mode of delivery.

Keywords: Labor induction, ultrasonographic transvaginal cervical length measurement, Bishop score, misoprostol. **Amaç:** Uygunsuz servikse sahip gebelerde, termde doğum indüksiyonunun başarısını öngörmede transvaginal servikal uzunluk ölçümü ve Bishop skorunun etkinliğini karşılaştırmak.

Doğum indüksiyonunun başarısını öngörmede servikal uzunluk ölçümü

Yöntem: Çalışmaya çeşitli nedenlerle doğum indüksiyonu uygulanan 173 miadında gebe kadın alındı. Tekil gebelik, baş gelişi, Bishop skoru <=4 indüksiyon gerektiren risk varlığı ve vaginal doğum için kontrendikasyonu olmayan olgular çalışmaya alındı. İndüksiyon ajanı olarak 25 µg veya 50 µg misoprostol kullanıldı. İndüksiyondan önce, transvaginal ultrasonografi ile servikal uzunluk tayini ve Bishop skoru tayini yapıldı. İndüksiyon - doğum intervali, doğum şekli, 24 saatte vaginal doğum ve indüksiyon – aktif faz intervalini belirlemede servikal uzunluk ve Bishop skorunun etkinliği karşılaştırıldı. Bishop skoru ve servikal uzunluğun indüksiyon başarısını saptamadaki değerlerini ve etkinliğini belirlemede lojistik regresyon analizi ve ROC eğrileri kullanıldı.

Bulgular: Ortalama servikal uzunluk 30.90±6.63mm, Bishop skoru 2.84±1.88 olarak bulundu. 121 (%69.9) olgu vaginal, 52 (%30.1) olgu sezaryen ile doğum yaptı. Lojistik regresyon analizlerinde servikal uzunluk ve doğurmuş olmak doğum şeklini öngörmede bağımsız değişkenler olarak bulundu (p=0.0101; p=0.0332). Bishop skorunun doğum şeklini öngörmede etkinliği gösterilemedi (p=0.6112). Doğum şeklini öngörmede servikal uzunluk için eğri altında kalan alan %63.8, en iyi kesme değeri 32mm alındığında sensitivite %67, spesifisite %58 olarak bulundu.

Sonuç: İndüksiyon öncesi servikal uzunluk ölçümü doğum şeklini öngörmede Bishop skoruna göre bağımsız bir değişken olarak görünmektedir. Bishop skoru ve parite ise bağımsız değişken olarak anlamlı görünmemektedir.

Anahtar Sözcükler: Doğum indüksiyonu, ultrasonografik servikal uzunluk ölçümü, Bishop skoru.

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Introduction

Induction of labor is applied to 20% of cases in gestation due to various reasons and 20% of cases applied induction require cesarean.[1] The indication mostly seen among indications of labor induction is postmature and it is reported that it decreases perinatal mortality explicitly when compared by spontaneous observation of labor induction.[2] In cases applied labor induction, traditionally Bishop score is used for determining whether the induction is successful or not. Determining Bishop score is a subjective method and it is stated that it does not have prediction value in determination of success of labor induction in many studies.[3,4]

Cervical measurement by transvaginal ultrasonography is used for determining labor period and obstetric results after labor induction.[5,6] In cases in which Bishop score is compared with measurement of transvaginal cervical length for predicting the success of labor induction, many studies are published stating that it is not better than Bishop score as an indicator as well as there are studies stating that cervical length measurement is successful in predicting induction success.[7,8] Also, it is stated that cervical length measurement by transvaginal ultrasonography is better than Bishop score as an indicator in predicting cesarean risk after labor induction.[9]

Our purpose in this study is to compare the values of cervical length measurement by transvaginal ultrasonography and Bishop score for predicting labor induction in term pregnants that we applied labor induction for various reasons.

Methods

This is a randomized prospective study including 173 cases that we applied labor induction by misoprostol due to maternal and fetal reasons in perinatology clinic of our hospital in between January 2004 and December 2006. The study was approved by ethic board of our hospital and detailed written consents were taken from all cases before beginning induction.

Criteria for taking cases into the study were determined as single gestation, head arrival, alive singular gestation existence, being intact of amnion membranes, existence of >37th gestational week as to the last menstrual period or as to the early gestational ultrasonographies of cases who did not know their last menstrual periods, not having any cesarean or any other uterine surgery, ≤4 Bishop score, existence of risk factor requiring induction (postmature, oligohydramnios, preeclampsia, anhydramnios) and not having any contraindication for vaginal delivery. Cases having history of cesarean or uterus operation, dead fetus, cases with vaginal bleeding unable to be explained, twin gestation and cases which were found as having 4500 g of fetal weight and having presentation anomaly were excluded from the study.

Before starting induction, vaginal probe was placed to vagina in all cases at 3 cm proximal of cervix without causing any change in shape and position of cervix. The cervix was displayed in sagittal plan by transvaginal ultrasonography when the bladder was empty. Distance between cervical exterior and interior space was taken by 3 different measurements along echogenic image of the cervical canal and the minimal value was recorded. Cervical length measurements were performed by 3 different experts from perinatology unit. Siemens Sonoline G-50 (Siemens Inc, Germany) 6-9 mHz vaginal was used as ultrasonography device.

Cases were separated into two groups in terms of misoprostol (Cytotec® 200 µg, Ali Raif Ilac Sanayi, Turkey) dose. Dose to be given were determined as 25 µg in single days of the month and as 50 µg in double days of the month. 25 µg or 50 µg misoprostol was applied vaginally as to the randomization and the dose was repeated in every 6 hours. Misoprostol was applied 4 times at the most. Fetal heart beat and uterine was monitored in all cases every 2 hours in terms of contractions and Bishop score was determined every 6 hours. Misoprostol dose was applied if there was no progress in Bishop score. In case of finding 4 cm space and 80% effacement after cervical determination, the operation was deemed as in active phase. When there was a pause in progress of

active phase more than 1 hour, oxytocin infusion (1 mU/min) was applied. Cervical space was evaluated by vaginal examination at least every 2 hours. Oxytocin dose was increased in every 15 minutes until at least 4 uterine contractions were obtained within 10 minutes. Amniotomy was applied to all cases when Bishop score was ≥6. Additional induction method was applied if the action did not begin 6 hours later after last misoprostol dose. Foley catheter inflated by 50 ml saline was applied to interior cervical space for all cases having Bishop score <6 and oxytocin was started simultaneously.

Primary results planned to be searched in this study were determined as;;

1. Induction – delivery interval
2. Delivery mode
3. Delivery existence in 24 hours
4. Induction– active phase interval.

Values of cervical length and Bishop score in determining induction success were compared in cases applied induction. Non-existence of vaginal delivery after induction was deemed as induction failure.

MedCalc 9.2 was used for statistical analysis. Chi-square test was used for categorical variables. Logistic regression analysis was used for determining values of Bishop score, cervical length, misoprostol dose and parity in establishing induction success. Activities for determining induction failure of Bishop score and cervical length measurement were performed by using ROC (Receiver-operating curve characteristics) curves. Values as p<0.05 were statistically deemed as significant.

Results

Induction indications of 173 cases being applied induction were as following; 80 cases (46.2%) postmature (gestational week >41), 26 cases (15.1%) oligohydramnios, 10 cases (5.8%) heavy preeclampsia, 15 cases (8.7%) light preeclampsia, 13 cases (7.5%) intrauterine growth retardation, 8 cases (4.6%) chronic hypertension, 6 cases (3.5%) gestational hypertension, 8 cases (4.6%) anhydramnios and 7 cases (4%) diabetes mellitus. 25 µg misoprostol was applied to 90 (52%) cases and 50 µg misoprostol were applied to 90 (48%) cases. Demographic qualities of cases are shown in Table 1.

Table 1. Demographic qualities of cases (n=173).

Multiparity n (%)	65 (%37.6)
Nulliparity n (%)	108 (%62.4)
Average age (S.D)	26.6±5.86
Average gestational week in induction (SD)	40.22±1.62 (37 – 42)
Average weight (kg) of pregnant (SD)	75.95±12.37

Average cervical length was found as 30.90±6.63 mm and Bishop score was found as 2.84±1.88. Active phase was successful in 149 cases and induction – active phase interval was averagely found as 13.93±10.92 in cases that active phase was successful. 54.3% of cases (94 cases) that active phase was successful were applied active phase within first 12 hours. 121 cases (69.9%) were delivered vaginally and 52 cases (30.1%) were delivered by cesarean. 56.6% of cases (98) were delivered vaginally within first 24 hours. Induction – vaginal delivery interval was found as 17.97±11.59 hours. 69.2% of cesarean cases (36 cases) were performed cesarean due to fetal distress. Tachysystole was appeared in 70 cases (40.5%) due to misoprostol usage. Average delivery weight was found as 3184.94±531.54. We found that misoprostol dose (25 µg or 50 µg) applied in our study had no effect for vaginal delivery, vaginal delivery in 24 hours and determining cesarean delivery due to fetal distress (p=0.502; p=0.352; p=0.05).

Logistic regression analysis showed that cervical length and multiparity are independent variables in determining delivery mode (p=0.0101; p=0.0332). Effects of Bishop score, misoprostol dose and parity could not be showed (Table 2).

The areas under the curve for cervical length and Bishop score for predicting vaginal delivery were found as 63.8% (95% CI 56.2 – 71) and 58.8% (95% CI 50.9 – 66) respectively. No significant difference was found when cervical length and Bishop score were compared in terms of area under curve (p=0.397). When the best segment value was taken 32 mm for cervical length, sensi-

Table 2. Effects of variables in determining vaginal delivery.

Parameters	Coefficient	Std. Error	P	Odds Rate	95% Confidence Interval (CI)
Amniotic fluid index	-0.0743	0.0547	0.1741	0.9284	0.8341 - 1.0334
Bishop score	0.0729	0.1434	0.6112	1.0756	0.8120 - 1.4248
Cervix space	0.1228	0.3887	0.7520	1.1307	0.5278 - 2.4222
Cervix length	-0.0791	0.0307	0.0101	0.9240	0.8699 - 0.9814
Diabetes	0.7727	1.0802	0.4744	2.1656	0.2606 - 17.9922
Approximate fetal weight	0.0003	0.0005	0.5884	1.0003	0.9992 - 1.0013
Cervical funneling	0.4142	0.5372	0.4407	1.5131	0.5280 - 4.3365
Weight of pregnant	-0.0267	0.0175	0.1274	0.9737	0.9408 - 1.0077
Hypertension	1.3605	0.6951	0.0503	3.8982	0.9981 - 15.2250
Gestational week	0.1685	0.2306	0.4651	1.1835	0.7531 - 1.8597
IUGG	0.0338	0.9318	0.9710	1.0344	0.1666 - 6.4243
Postmature	-0.4249	0.7083	0.5486	0.6538	0.1631 - 2.6208
Being Labored	1.9168	0.8999	0.0332	6.7989	1.1653 - 39.6678
Oligohydramnios	0.1632	0.5987	0.7851	1.1773	0.3641 - 3.8067
Parity	-0.0083	0.3762	0.9823	0.9917	0.4744 - 2.0731
Age	-0.0596	0.0471	0.2056	0.9421	0.8590 - 1.0332
Misoprostol dose	0.2523	0.3806	0.5074	1.2870	0.6104 - 2.7134

tivity was 66.9% (95% CI 57.8 – 75.2), specificity was 57.6% (95% CI 43.2 – 71.3), positive decisiveness value was 79% and negative decisiveness value was 43% (Figure 1).

When Logistic regression analysis was used for determining vaginal delivery in 24 hours, it was found that cervical length and Bishop score had no effect (p= 0.063; p= 0.308). It was observed that cervical length was not better than Bishop score as an indicator for determining vaginal delivery in 24 hours. Area under curve was found as 60.9% for cervical length and 60.4% for Bishop score. When the best segment value was taken 28 mm for cervical length, sensitivity was 65%, specificity was 73%, positive decisiveness value was 68.8% and negative decisiveness value was 50.5% for predicting vaginal delivery in 24 hours Cervical length and gestational week were found as independent variables in accomplishing active phase (p=0.002; p=0.039); but it was also found that Bishop score, misoprostol dose and being delivered were not effective in predicting active phase (p=0.112; p=0.146; p=0.324). Even cervical length seemed better than Bishop score in predicting active phase; it was not a strong indicator for prediction. Areas under the curve were found as 67% for cervical length and 59% for Bishop score. When the best segment value was taken ≥32 mm for cervical length, its sensitivity was 64.4%, specificity was 70.8%, positive decisiveness value was 93.2% and negative decisiveness value was 24.3% in accomplishing active phase.

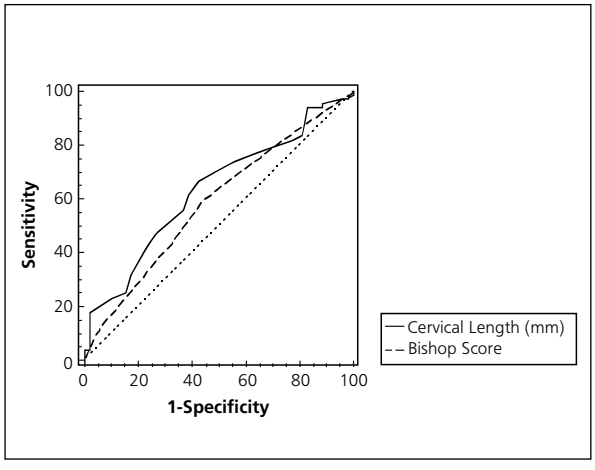

Figure 1. ROC curve for cervix length (When the best segment value is taken 32 mm for cervical length, sensitivity is 66.9%, specificity is 57.6%, positive decisiveness value is 79% and negative decisiveness value is 43%).

Discussion

Labor induction is equal with increased cesarean risk when compared with spontaneous delivery action if especially together with inappropriate cervical state.[10,11] One of the frequently used methods for determining cervical maturation is Bishop score; but Bishop score has limited effect in determining the success of labor induction.[3,4] Thus,

transvaginal ultrasonographic cervical length measurement was begun to use in predicting induction success and it was showed as a good indicator in predicting successful labor induction in many studies.[5,6,9] When Ware and Raynor5 took best segment value as 30 mm for cervical length in determining vaginal delivery, they found its sensitivity as 91%, specificity as 92%. When it is evaluated in terms of segment value (30 mm vs 31 mm) used in measurement of transvaginal cervical length and vaginal labor rates (69% vs 70%), rate of multipara cases in that study which has same values as in our study was reported as 58%. Also, average cervical length was calculated as 25 mm.

Rane et al[12] found parity and cervical length measurement as significant independent variables in determining cesarean possibility in their study in which they examined 382 postmature cases and they found sensitivity as 84% and specificity as 59% when they took best segment value as 24 mm for cervical length. Also, they showed that cesarean rate in cases in which induction-labor interval exceeds 24 hours increases three times as to those labored before 24 hours. Pandis et al[13] found that cervical length, parity and Bishop score were independent variables in determining delivery within 24 hours in series of 240 cases being applied induction between 37th-42nd gestational weeks. When they took segment value as 28 mm for cervical length and Bishop score as 3 in determining successful labor induction for ROC curve, they found measurement of cervical length better than Bishop score as an indicator. Baytur et al[14] found cervical length as the only independent variable in determining induction-labor period and cesarean possibility in their study consisting of 97 cases and they found that limit value was 18 mm for cervix length in determining cesarean risk of ROC curve and that it was better than Bishop score. But vaginal misoprostol was used as an induction agent only in 13 pregnants in this study and it is important that oxytocin application was performed for remaining 84 patients. Also there are some studies in literature which state that cervical length measurement is not an ideal test for determining success of labor induction.[7,8,16] Ramon et al[7] found in their study consisting of 106 cases that cervical length was not better than Bishop score as an indicator in determining delivery mode. Gonen et al[15] found a significant correlation between Bishop score and parity in determining delivery mode and delivery period but they did not find a significant relation with cervical length. Caliskan et al[16] found in their study consisting of 74 cases that cervical length measurement had a value for amount determiner in cases being applied misoprostol and induction but they stated that it was not an ideal test in predicting unsuccessful induction. In our study it was found that cervical length and being labored were independent variables for predicting delivery mode. When we took the best segment value as 32 mm for cervical length in determining vaginal delivery, sensitivity was found as 66.9% and specificity was found as 57.6%. It is understood that measurement cervical length is not a strong indicator for prediction even if it has some decisiveness quality when examining area values under ROC curve for each primary result.

Induction agent and dose used in labor induction are factors which can be effective on delivery mode and period. There are different results with amniotome application, oxytocin, vaginal or oral misoprostol used as induction agent and standard protocols can not be developed by used doses.[6,14,17] In studies in which high dose and low dose misoprostol regimes are compared, no difference was found in terms of delivery mode and delivery failure within 24 hours.[18] Factors such as maternal and fetal weights, parity and cervical funneling may affect delivery period. Especially parity is reported as independent variable in determining induction success in many studies.[5,12,13] Caliskan et al[16] found that parity was not a good indicator in determining induction failure. Roman et al[7] found in their study that cervical funneling had no activity in determining labor induction success. Boozarjomehri et al[19] set forth that establishing cervical funneling in ultrasonography is a good prediction way in determining delivery period. Chandra et al[20] reported that increase of maternal weight affects latent phase and induction – labor period. It was found in our study that maternal weight, parity and cervical funneling are not good indicators for determining induction success (p=0.127; p=0.985;

p=0.441). Also, it was found that misoprostol dose (25 µg or 50 µg) applied in our study had no effect for vaginal delivery, vaginal delivery in 24 hours and determining cesarean delivery due to fetal distress (p=0.502; p=0.352; p=0.05).

Conclusion

Cervical length and being vaginally labored at least once are seem as independent variables in predicting successful labor induction by vaginal misoprostol. Cervical length is not a strong indicator in predicting delivery mode in cases induced by misoprostol even if it has decisiveness quality.

Referance

1. RCOG. Induction of labour. In Evidence – based Clinical Guidline Number 9. London; RCOG Clinical Support Unit, 2001.
2. Sue – A – Quan AK, Hannah ME, Cohen MM, Faster GA, Liston RM. Effect of labour induction on rates of stillbirth and cesarean section in post – term pregnancies. *CMAJ* 1999; 160: 1145-49.
3. Williams MC, Krammer J, O'Brein WF. The value of the cervical score in predicting successful outcome of labor induction. *Obstet Gynecol* 1997; 90: 784-9.
4. Hendrix NW, Chauhan SP, Morrison JC, Magann EF, Martin JN, Devoe LD. Bishop score: a poor diagnostic test to predict failed induction versus vaginal delivery. *South Med J* 1998; 91: 248-52.
5. Ware V, Raynor BD. Transvaginal ultrasonographic cervical measurement as a predictor os successful labor induction. *Am J Obstet Gynecol* 2000; 182: 1030-2.
6. Rane SM, Guirgis RR, Higgins B, Nicolaides KH. The value of ultrasound in prediction of successful induction of labor. *Ultrasound Obstet Gynecol* 2004; 24: 538-49.
7. Roman H, Verspyck E, Vercoustre L, Degre S, Col JY, Firmin JM, et al. Does ultrasound examination when the cervix is unfavorable improve the prediction of failed labor induction? *Ultrasound Obstet Gynecol* 2004; 23: 357-62.
8. Bartha JL, Romero – Carmona R, Martinez –Del – Fresno P, Comino – Delgado R. Bishope score and transvaginal ultrasound for preinduction cervical assessment: a randomized clinical trail. *Ultrasound Obstet Gynecol* 2005; 25: 155-9.
9. Gabriel R, Darnaud T, Chalot F, Gonzalez N, Leymarie F, Quereux C. Transvaginal sonography of the uterine cervix prior to labor induction. *Ultrasound Obstet Gynecol* 2002; 19: 254-7.
10. Yeast JD, Jones A, Poskin M. Induction of labor and the relationship to cesarean delivery: a review of 7001 consective inductions. *Am J Obstet Gynecol* 1999; 180: 628-33.
11. Seyb ST, Berka RJ, Socol ML, Dooley SL. Risk of cesarean delivery with elective induction of labor at term in nulliparous women. *Obstet Gynecol* 1999; 94: 600-7.
12. Rane SM, Pandis GK, Guirgis RR, Higgins B, Nicolaides KH. Pre - induction sonographic measurement of cervical length in prolonged pregnancy: the effect of parity in the prediction of the need for Cesarean section. *Ultrasound Obstet Gynecol* 2003; 22: 45-8.
13. Pandis GK, Papageorghiou AT, Ramanathan MO, Thompson OM, Nicolaides KH. Preinduction sonographic measurement of cervical length in the prediction of successful induction of labour. *Ultrasound Obstet Gynecol* 2001; 18: 623-8.
14. Baytur Y, Uyar Y, Özçakır HT, İnceboz İ, Laçin S, Erbay G, ve ark. Doğum indüksiyonu öncesinde transvajinal serviks ölçümü: Bishop skoru ve paritenin değerlendirilmesi. *Perinatoloji Dergisi* 2004; 12: 33-7.
15. 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: 183-7.
16. Çalışkan E, Doğer E, Çakıroğlu Y, Özkan S, Özeren S, Çorakçı A. Does cervical length measurement help to predict the success rate of labor induction using misoprostol at term in women with stictly unfavorable cervix? *J Turkish German Gynecol Assoc* 2006; 7: 184-8.
17. Watson WJ, Stevens D, Welter S, Day D. Factors predicting successful labor induction. *Obstet Gynecol* 1996; 88: 990-2.
18. Hofmeyr GJ, Gülmezoglu AM. Vaginal misoprostol for cervical ripening and induction of labour. The Cochrane Database of Systematic Reviews 2003, Issue 1. Art. No: CD000941. DOI:10.1002/14651858.CD000941.
19. Boozarjomehri F, Timor-Tritsch I, Chao CR, Fox HE. Transvaginal ultrasonographic evaluation of the cervix before labor: presence of cervical wedging is associated with shorter duration of induced labor. *Am J Obstet Gynecol* 1994; 171: 1081-87.