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Hend Salah Abd Almonaem

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Comparison Between Manipal Scoring System and Modified Bishop Scoring in Predicting Successful Labor Induction

Boshra Nasr Ali, Hend Salah Abd Almonaem, Fatma Salah Mahmoud Yousef*

Department of Obstetrics and Gynecology, Faculty of Medicine for Girls, Al-Azhar University, Cairo, Egypt

Abstract

In obstetrics, inducing labor stimulates uterine contractions after the viability phase but before spontaneous labor begins, regardless of the cervix or amniotic membrane state of the pregnant woman. Our study aimed to contrast the effectiveness of the Bishop score in predicting successful induction of labor with that of the Manipal scoring system, which is based on sonographically identical components. One hundred primigravida pregnant women hospitalized to Kafr Al Sheikh Hospital for labor induction were included in this cross-sectional study. These pregnant women underwent labor induction then we compared Manipal scoring system and its performance against Bishop scoring system in predicting successful labor. Our results revealed that using receiver operating characteristic curve analysis, the Manipal cervical scoring system can determine successful induction with the accuracy of 99.9%. The sensitivity, specificity, positive predictive value, and negative predictive value were 98.61, 96.43, 98.61, and 96.43%, respectively ($P < 0.001$). Burnett modification of Bishop score can determine successful induction with the accuracy of 94.0%. The sensitivity, specificity, positive predictive value, and negative predictive value were 77.78, 96.43, 98.25, and 62.79%, respectively ($P < 0.001$). Regarding our results, we can conclude that when compared to the Bishop score, the Manipal cervical scoring system is a more objective technique for predicting the success of labor induction. It is quick and painless to get, measurable and repeatable, and it gives a better indication of whether or not an intraocular lens implant will work.

Keywords: Induction of labor, Manipal scoring system, Modified Bishop score, Singleton pregnancy

1. Introduction

Induction of labor refers starting labor before it naturally begins to facilitate the delivery of the fetoplacental unit. Inductions occur at varying intervals depending on the setting and organization.¹

Both the mother and the baby can benefit from induction if it is performed for the right reasons and using safe practices. The purpose of induction is to facilitate a safe and all-natural vaginal birth. Women should be given treatment and care that is tailored to their own needs and choices. Inducing labor is a medical procedure that can have serious consequences for the health of the mother and the baby, so pregnant women get a chance to discuss their

options with their doctors before any decisions are made for them.²

It does not matter if the membranes are ruptured; in obstetrics, the goal of induction of labor is to stimulate uterine contractions after the viability period but before spontaneous labor begins. Approximately 20% of all pregnancies currently undergo induction of labor for a variety of maternal and fetal causes, and roughly 20% of all labor inductions result in cesarean sections.²

Cervical characteristics, also known as 'readiness of cervix' or 'cervical ripening,' play a major role in determining whether an induced labor will end in a successful vaginal delivery. The Bishop score is the gold standard traditional method of assessing

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* Corresponding author at: Department of Obstetrics and Gynecology, Faculty of Medicine for Girls, Al-Azhar University, Cairo 33651, Egypt.
E-mail address: salahfatma497@gmail.com (F.S.M. Yousef).

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favorability of the cervix in making this determination. However, research has demonstrated that this evaluation has low predictive value because of its subjectivity and reliance on interobserver variability.³

Transvaginal ultrasonography is a well-tolerated, objective approach for measuring the cervical length and identifying internal os alterations. Quantitative and easily reproducible transvaginal ultrasonography measures of cervical length (including the supravaginal region) can potentially eliminate interobserver variability in cervical length measurement. Cervical evaluation using transvaginal ultrasonography can help determine the likelihood of a successful induction of labor, defined as cervical dilation of more than 4 cm accompanied by uterine contractions.³

This research aims to examine how well the Manipal scoring system fares in comparison to the Bishop score at predicting whether or not induction of labor will be effective.

2. Patients and methods

A cross-sectional study was conducted on 100 primigravida pregnant women with singleton pregnancy admitted for labor induction and then compared between the Manipal scoring system and its performance on the modified Bishop scoring system.

This study was conducted at Kafr Al Sheikh General Hospital, Ministry of Health from August 2020 to January 2022.

2.1. Inclusion criteria

Nulliparous pregnancies, live births, and gestational ages beyond 37 weeks are all considered high-risk.

2.2. Exclusion criteria

Women who have had a cesarean section or uterus surgery before, bleeding before birth, breech, oblique, or transverse position of the fetus, anatomical abnormalities of the pelvis, such as a shortened pelvis, fetal development disorders, including intrauterine growth restriction and macrosomia acute herpes simplex virus infection with invasive cervical cancer.

2.3. Indication for induction of labor

Pre-eclampsia, gestational and preexisting diabetes mellitus, reduced fetal movements, advanced

maternal age, prelabor rupture of membranes, and suspected macrosomia.

2.4. Preparation of the patients for induction

2.4.1. Operational design

Every woman in the research will be given a detailed description of the procedure. Before beginning the trial, all participants were given information about the study and requested to sign a consent form before collecting any data.

Sample size (n):

$$\left(\frac{Z_{a/2} + Z_B}{P_1 - P_2}\right)^2 (p_1q_1 + p_2q_2)$$

Takazawa and Morita.⁴

n = sample size.

$Z_{a/2}$ (the critical value that divides the central 95% of the Z distribution).

Z_B (the critical value that divides the central 20% of the Z distribution).

P_1 = prevalence in case group.

P_2 = prevalence in the control group.

$q = 1 - p$.

Epi-Info STATCALC was used to calculate the sample size by considering the following assumptions: 95% two-sided confidence level, with a power of 80% and an error of 5% odds ratio calculated = 1.115. The final maximum sample size from the Epi-Info output was 59. Thus, the sample size was increased to 67 cases to assume any dropout cases during follow-up.

2.5. Methods

All patients had a thorough history taken and were examined (including a physical, an abdominal, a local clinical, and a transvaginal examination).

2.5.1. Viability phase

Fetal viability is the ability of a human fetus to survive outside the uterus. Medical viability is generally between 23 and 24 weeks gestational age (Table 1).

Table 1. Items of the Manipal cervical scoring system.⁵

Scores	0	1	2
Manipal cervical scoring system			
Cervical length	>3 cm	2–3 cm	<2 cm
Funnel length	Absent	≤0.5 cm	<0.5 cm
Funnel width	Absent	≤0.5 cm	<0.5 cm
Cervical position	Curved	–	Straight
Distance of presenting part to external os	>3 cm	2–3 cm	<2 cm

2.5.2. Ethical considerations

The protocol for the study was submitted to the Al-Azhar University Ethical Committee for Obstetrics and Gynecology, as well as the Al-Azhar University Ethical Committee for the Faculty of Medicine for Girls, to gain approval to proceed. Following an explanation of the objectives and methods of the study, everyone who took part in the study gave their informed authorization, both orally and in writing. Confidentiality and personal privacy were also protected at every stage of the research.

2.6. Data management and statistical analysis

Using Microsoft Excel software, the data were coded, entered, and evaluated after being collected during the history, basic clinical examination, laboratory investigations, and outcome measurements. After that, the information was prepared for analysis by being imported into the program known as Statistical Package for the Social Sciences (version 20.0) IBM SPSS statistics (Statistical Package for Social Sciences) software version 22.0, IBM Corp., Chicago, USA. Quantitative data can be expressed as numbers and percentages to fit the context better. The quantitative group is shown as a mean \pm SD. The significance of the discrepancies was analyzed using Pearson and Spearman's correlation coefficients. The thresholds for statistical significance were chosen as less than 0.05 and less than 0.001, respectively.

3. Results

The average age of these patients was, as seen in Table 2: 25.54 ± 5.22 , the mean BMI was 27.44 ± 3.58 , the mean gestational age was 39.13 ± 1.50 and less than half (47.0%), women had a history of previous abortions.

Table 3 showed that 57% of cases had Manipal scoring system between 6 and 10, 22% of cases had

Table 2. Demographics of the women subjected to the study.

Parameters	Studied women (N = 100) [n (%)]
Age (years)	
Mean \pm SD	25.54 \pm 5.22
Range	16.0–39.0
BMI (kg/m ²)	
Mean \pm SD	27.44 \pm 3.58
Range	21.4–39.0
Gestational age (weeks)	
Mean \pm SD	39.13 \pm 1.50
Range	37.0–42.0
History of previous abortions	
Negative	53 (53.0)
Positive	47 (47.0)

Table 3. Distribution of Manipal cervical scoring system among the studied women.

Manipal cervical scoring system	Studied women (N = 100) [n (%)]
Manipal cervical scoring system	
Mean \pm SD	6.01 \pm 2.35
Range	–10.0
0–3	21 (21.0)
3–6	22 (22.0)
6–10	57 (57.0)

Manipal scoring system between 3 and 6 and 21% had Manipal scoring system between 0 and 3.

Table 4 showed that 57% of cases had a modified Bishop score between 6 and 10, 41% of cases had modified bishop score between 3 and 6, and 2% had a modified Bishop score between 0 and 3.

Table 5 showed that the mean time of induction to labor was 15.65 ± 4.63 h with range from 8 to 24 h with 33% of cases delivered within 8–12 h, 26% of cases delivered within 17–20 h, 23% of cases delivered within 13–16 h and 18% of cases delivered within 20–24 h. Seventy-two percent of cases showed successful induction of labor and delivered by VD meanwhile, 28% of cases showed failed

Table 4. Distribution of the Burnett modification of Bishop score among the studied women.

Burnett modification of Bishop score	Studied women (N = 100) [n (%)]
Burnett modification of Bishop score	
Mean \pm SD	7.0 \pm 1.93
Range	3.0–10.0
0–3	2 (2.0)
3–6	41 (41.0)
6–10	57 (57.0)

Table 5. Distribution of time of induction, partogram, outcome, and complications among the studied women.

Parameters	Studied women (N = 100) [n (%)]
Time from induction to labor (h)	
Mean \pm SD	15.65 \pm 4.63
Range	8.0–24.0
8–12	33 (33.0)
13–16	23 (23.0)
17–20	26 (26.0)
20–24	18 (18.0)
Partogram	
Progress	72 (72.0)
Arrest	28 (28.0)
Outcome of induction	
Successful	72 (72.0)
Failed	28 (28.0)
Complications	
Arrest of fetal descent	12 (12.0)
Arrest of dilatation	11 (11.0)
Fetal distress	5 (5.0)

Table 6. Validity of the Manipal cervical scoring system and the Burnett modification of the Bishop score in predicting successful labor induction.

Parameters	Cutoff value	AUC	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	P value
Manipal cervical scoring system	≤6.0	0.992	98.61	96.43	98.61	96.43	99.9	<0.001*
Burnett modification of Bishop score	>7.0	0.939	77.78	96.43	98.25	62.79	94.0	<0.001*

AUC, area under curve; NPV, negative predictive value; PPV, positive predictive value.

P value >0.05: Not significant, P value <0.05 is statistically significant, * statistically significant.

induction of labor and delivered by cesarean section. Among 28 cases of failed induction 12 cases had arrested of fetal descent, 11 cases had arrested of dilatation, and five cases showed fetal distress.

According to the data presented in Table 6, the Manipal cervical scoring system has an accuracy of 99.9% when determining whether or not an induction was successful. The sensitivity, specificity, positive predictive value, and negative predictive value were, respectively, 98.61, 96.43, 98.61, and 96.43% ($P < 0.001$).

The induction success rate may be predicted with a 94.0% degree of certainty using the Burnett-modified Bishop score. Results showed a 77.78% sensitivity, a 96.43% specificity, a 98.25% positive predictive value, and a 62.79 ($P < 0.001$) (Figs. 1 and 2).

Table 7 showed a significant positive correlation between the Manipal cervical scoring system and Burnett modification of Bishop score ($P < 0.001$) in predicting successful induction of labor.

4. Discussion

Inducing labor is an obstetric procedure that is performed in around 1.4–35% of all deliveries for either maternal or/and fetal causes. This operation is quite routine and is practiced worldwide.⁶ Induction of labor has been shown to significantly reduce perinatal mortality when compared to expectant management for postterm pregnancies. As a result, many studies have analyzed potential factors that influence whether or not labor induction is successful. Cervical ripening is significant because it indicates that the mother's cervix has developed the favorable features necessary for labor to start and continue normally, leading to a vaginal birth.⁷

The most important findings of this investigation were as follows:

Regarding the sociodemographic data of the studied group, our results showed that women's ages varied widely from 25.54 ± 5.22 years, from 16

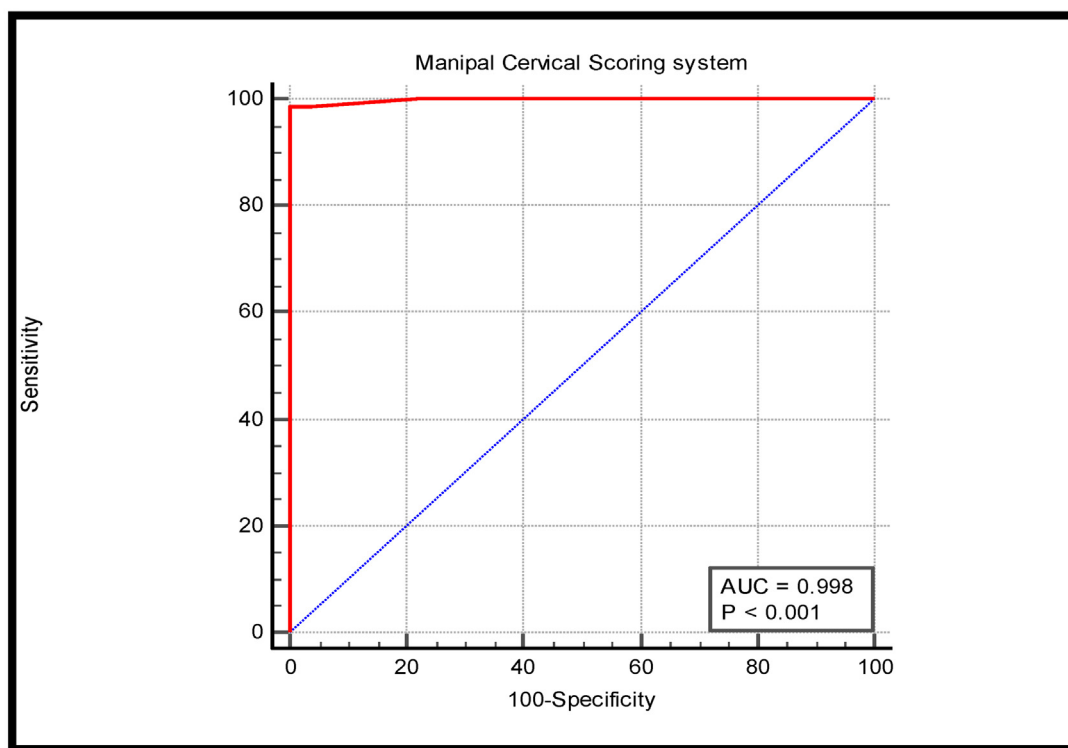


Fig. 1. ROC curve of Manipal cervical scoring system in prediction of successful induction of labor. ROC, receiver operating characteristic.

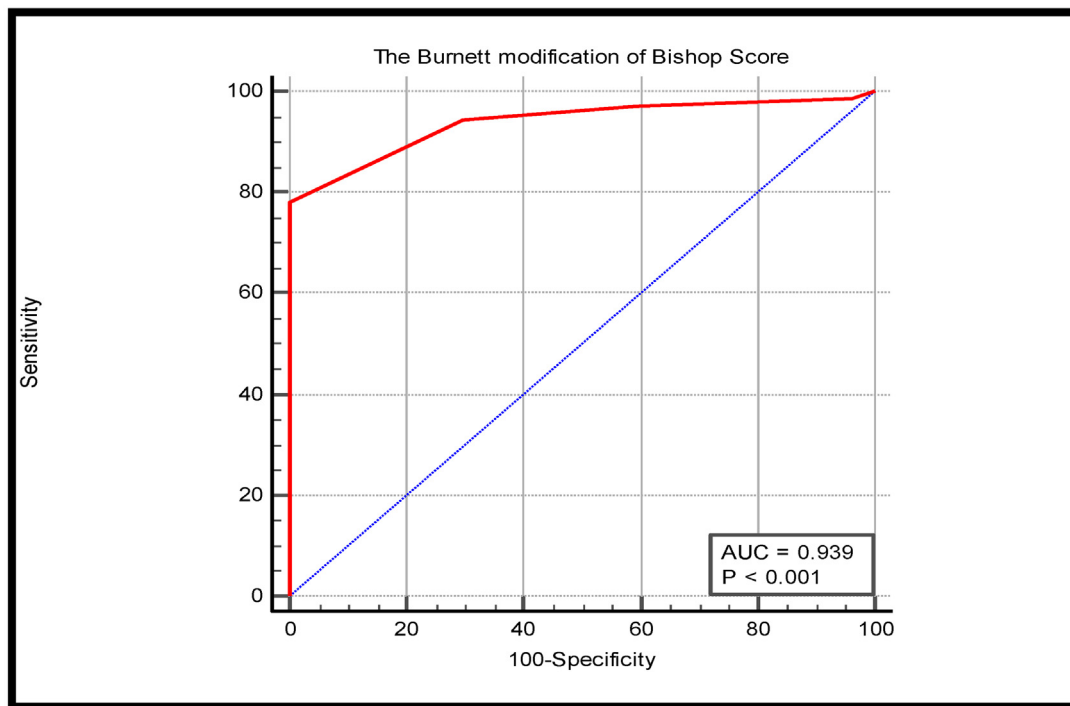


Fig. 2. ROC curve of Burnett modification of Bishop score in the prediction of successful induction of labor. ROC, receiver operating characteristic.

Table 7. Correlation between Burnett modification of Bishop score and Manipal cervical scoring system.

	Manipal cervical scoring system	
	r	P value
Burnett modification of Bishop score	0.547	<0.001*

P value >0.05: Not significant, P value <0.05 is statistically significant, * statistically significant.

to 39 years old, on average. The average BMI was $27.44 \pm 3.58 \text{ kg/m}^2$. The gestational age ranged from 37 to 42 weeks, with a mean SD of 39.13 ± 1.50 weeks.

In our study, all women were nulliparous, and less than half (47.0%) of women had a history of previous abortions.

El Bishry *et al.*⁵ funded this research to evaluate the Manipal cervical scoring system versus the Bishop score. The study enrolled 105 women with a mean age of 27 ± 5 years, mean BMI of $29.0 \pm 3.2 \text{ kg/m}^2$, mean gestational age was 277 ± 10 days. 82.9% of women had a history of previous abortions.

Furthermore, Khazardoost *et al.*⁸ used a sample size of 100 participants with a mean age of 251.4 years. The gestational ages of the participants varied from 37 to 42 weeks (GA = 39.1 ± 3.0 weeks; BMI = $24.1 \pm 33.5 \text{ kg/m}^2$).

Our study showed that the mean Manipal cervical score was 6.01 ± 2.35 with a range from 1 to 10 and

median was 7 and the most predicting successful value was 79.2% (6–10 score). The mean modified Bishop score was 7.0 ± 1.93 with a range from 3.0 to 10.0 and median was 7.0 and the most predicting successful value was 77.8% (6–10 score) among the studied women.

The average Bishop score was 4.3, according to the research by Ezebialu *et al.*,⁷ and the average cervical length was 25.2 mm, according to transvaginal ultrasonography.

As well, Alanwar *et al.*⁹ reported that Bishop's score was on average 6 ± 1 and cervical length was average at $22 \pm 4\%$.

In our study, the mean time of induction to labor was 15.65 ± 4.63 h with a range from 8 to 24 h, with a third of patients having time of 8–12 h (41.7%). Partogram showed successful induction in 72% of cases and delivered vaginally and arrest in 28% of cases and delivered by cesarean section.

We also found that 12 (42.9%) cases out of 28 cesarean section delivery had arrests of fetal descent, 11 (39.3%) cases out of 28 cesarean section delivery had the arrest of dilatation and five (17.9%) cases out of 28 cesarean section delivery showed fetal distress.

According to the results of the study by Hassan and colleagues, the majority of births (83%) occurred via spontaneous vaginal delivery, while 17% occurred via lower segment cesarean section, including nine cases of failed intraocular lens and

eight cases of fetal distress. In this study, the average time from induction to delivery was 12.16 ± 4.06 h, with a range of 6–24 h. The average induction time was 8.44 ± 3.15 h. The time of birth was around 24 h after induction. In 79 (95.2%) females and four (4.8%) females for more than 24 h.¹⁰

Fetal occiput position was anterior in 92.7% of women who underwent successful intraocular lens, and posterior in 7.3%. Increase Burnett adjustment of Bishop score and Manipal cervical scoring system had statistically significant correlated successful induction of labor, the occiput was anterior in 52.2% of women with a failed intraocular lens and posterior in 47.8% of women with a successful intraocular lens.

Also, neither group differed significantly from the other regarding the following demographic variables: mean mother age, height, weight, BMI, ethnicity, and gestational age at induction.⁶ However, there were considerable disparities between vaginal and cesarean deliveries with respect to the following outcomes: higher parity, shorter cervical length, the absence of cervical funneling, a higher Bishop score, a shorter time from induction to birth, and lower birth weight.⁴

In addition, the study by Gibreil *et al.*¹¹ revealed that the Bishop score, as determined by transvaginal sonography, the cervical length, and the posterior cervical angle, all had substantial positive correlations with a successful induction.

As well, Alanwar *et al.*⁹ reported that successful induction correlated significantly with increase the Bishop score and decrease cervical length that measured by transvaginal sonography.

To evaluate the diagnostic use of the Manipal cervical scoring system for induction success, a receiver operating characteristic study was conducted.

Using receiver operating characteristic curve analysis, Manipal cervical scoring system can determine successful induction with the accuracy of 99.9%. The positive predictive value, negative predictive value, sensitivity, and specificity were 98.61, 96.43, 98.61, and 96.43%, respectively ($P < 0.001$).

With comparable values with our results, the study by El Bishry *et al.*⁵ reported that Manipal score had excellent predictive value with area under curve of 0.940 (95% confidence interval = 0.876–0.977; $P < 0.0001$). The best cutoff criterion is a score more than 5, which had a sensitivity of 91.5% and specificity of 91.3%.⁵

Area under curve of 0.907 (95% confidence interval = 0.835–0.955; $P = 0.001$) was obtained, consistent with the original study that developed the Manipal cervical scoring. With a sensitivity of 77.42 and specificity of 92.86, however, the optimum cutoff score in the first trial was more than 4.³

Burnett modification of Bishop score can determine successful induction with the accuracy of 94.0%. The sensitivity, specificity, positive predictive value, and negative predictive value were 77.78, 96.43, 98.25, and 62.79%, respectively ($P < 0.001$).

El Bishry *et al.*⁵ found similar results, concluding that the Bishop score's area under curve was 0.863, indicating that it was a highly predictive measure (95% confidence interval = 0.783–0.923; $P = 0.0001$). A score of more than 4 was the optimal cutoff, with a sensitivity of 98.8% and a specificity of 69.6%.

Regarding the correlation between Manipal cervical scoring systems Burnett modification of Bishop score. It was found that the Manipal cervical scoring system and Burnett's modified bishop score had a strong positive correlation ($P < 0.001$).

With comparable values with our results the study by El Bishry *et al.*⁵ who reported that there was significant positive correlation between Manipal cervical scoring systems Burnett modification of Bishop score.

4.1. Conclusion

Inducing labor is a common obstetric practice that may be necessary for the health of the mother or the baby in anywhere from 1.4 to 35.0% of births. Studies comparing induction to expectant management in late pregnancies indicated a significant reduction in perinatal mortality was related to induction.

4.2. Recommendation

Further comparative studies with large sample size are needed to confirm that Manipal cervical scoring system is a better objective tool to predict the outcome of labor induction compared to the modified Bishop score. To recommended that Manipal scoring system to be done routinely before every case for induction of labor to give this study the powerness for detection of induction of labor. We must carefully select the cases that will undergo induction of labor with high Manipal scoring system and modified Bishop score to achieve the highest success rate.

Ethics information

Its was approved by faculty.

Funding

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Conflict of interest

There are no conflicts of interest.

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