

# Body Mass Index, Modified Bishop Score and Transvaginal Sonographic Measurement of the Cervical Length as Predictors of Successful Induction of Labour by Misoprostol

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## Abstract

**Introduction:** All through the world, induction of labour fails in 20% of cases and thus cesarean section is performed. Obesity is a risk factor for undesired results of pregnancies. Although the Bishop score is simple and easy to apply, it is a subjective evaluation method and results may vary according to the clinical experience of the person applying it. Transvaginal cervical measurement can be more objective criterion in assessing the success of labor induction. We aimed to identify the proper characteristics of the pregnant women, which can go for successful induction of labour.

**Method:** Induction of labor for 100 women using vaginal misoprostol was done following identification of their BMI, modified bishop score and transvaginal cervical length. All women were pregnant  $\geq 38$  weeks, singleton, cephalic presentation, intact fetal membranes.

**Results:** About 92 women had successful induction of labour (group 1) while the remaining eight women had failed induction (group 2). BMI did not show statistical significance however, the modified Bishop score and the transvaginal cervical length showed high statistical significance. Using the modified bishop score 2 as a cutoff value showed sensitivity 89.1%, and specificity 62.5% while using the transvaginal cervical length 2.65 as a cutoff value showed sensitivity 72.8% and specificity 100%.

**Conclusion:** Induction of labour by vaginal misoprostol is very promising in term women providing identification of their modified Bishop score and their transvaginal cervical length.

**Keywords:** Induction of labour; BMI; modified Bishop score; transvaginal cervical length; misoprostol.

## Introduction

Induction of labour is a method of timed delivery of the fetus that can be requested in certain circumstances. It was obviously seen how the induction of labour differ from an area to other and is applicable is an increasing

manner. In the United States and Canada, it reached more than 20%<sup>1</sup>.

Assessment of the cervix is a crucial prognostic factor for the outcome of labour induction. Once labour starts, many changes were detected in the cervix matter involving the influx of certain chemicals into the cervix and efflux of special materials that dismantle the collagen, remodeling the cervical tissue. In addition, it has been detected prominent changes in the level of glycosaminoglycans and release of cytokines<sup>2</sup>.

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In 1964, a “pelvic score” was published, now known as the Bishop score, which described a patient’s suitability for elective labor induction. This idea was based on the assessment of cervical factors including dilatation, effacement, consistency, position and station. He concluded that labour induction was successful if the total Bishop score reached 9 or beyond. Time induction of labour was suitable for multiparous women who reached 37 weeks gestation and this examination showed an adequate size fetus with head down presentation. Despite that, this scoring system was in common use in any pregnant woman not strictly the term. Although all the changes to the original Bishop’ score, this first score stand to the common one used in practice <sup>3</sup>.

Successful induction was closely related the woman weight. It was prominent that candidates with a weight on the lower side have more the chance to have a vaginal delivery within 12 and 24 hours of start of induction and those with weight on the higher side are more prone to end up by a cesarean n delivery even if multiparous <sup>4</sup>.

Many obstetricians have been in circumstances requiring a timed delivery of their patients and so they tried a plenty of methods. The main idea was to deliver their patients by vaginal delivery and this occur by bringing uterine contractions in a uterus already in a quiescent state. The rate of labour induction has risen up in the United States in the last decades and the number of induced women has reached more than the double by 2009. These enormous changes in practice were related to many factors including from one side the candidate compliance and from the other side the plenty of methods used for induction <sup>5</sup>.

Our study was aiming to identify the proper criteria of the candidate, which can go for successful induction of labour.

### Methods:

This prospective study was conducted on 100 women who attended a private hospital between October 2012 and December 2015 after approval of the ethical committee of the national research centre. The inclusion criteria involved full-term pregnancy ( $\geq 38$  weeks) with a single, living fetus of cephalic presentation, intact fetal membranes. The exclusion criteria involved women with previous caesarean section, cephalopelvic disproportion, placenta previa or vasa previa, transverse fetal lie, prolapsed umbilical cord, multifetal gestation, abnormal fetal heart rate patterns requiring emergency

delivery, estimated fetal weight  $\geq 4$  kg, fetal demise, chorioamnionitis, and previous uterine scar.

First, each woman was assessed, by taking full history and examination, to check her age, weight, height, parity, gestation and for any medical problem. The study population was categorized into six classes of BMI=weight/height<sup>2</sup> (kg/m<sup>2</sup>), based on the WHO definition; underweight  $<18.5$ , normal weight 18.5–24.9, overweight 25–29.9, class I obesity 30–34.9, class II obesity 35–39.9 and class III obesity  $\geq 40$ .

Via the ultrasound machine Sonoace R7 (Samsung Medison, Korea), transabdominal ultrasound was performed for each woman to obtain the fetal biometry as well as the fetal weight using the formula by Hadlock. Using a 5 MHz transvaginal probe, the cervical length was measured twice in the sagittal plane along the length of the endocervical canal with simultaneous visualization of the internal and external cervical os, and then the mean of the two measurements was calculated.

All women were informed about the induction procedure including the use of misoprostol and its potential risks (hyperstimulation, uterine rupture and the possibility to fail and go for caesarean section). A digital vaginal examination was done to identify woman’s modified Bishop score, which includes; the cervical dilatation, station, consistency, position as well as the cervical length, which has replaced the item “effacement” in the original Bishop score.

Each woman was subjected for external cardiotocography (CTG) for 30 minutes before starting induction. A dose of 50 micrograms of misoprostol is put intravaginally and repeated after 6 hours if no progress occurs (maximum dose of misoprostol was 100 mcg). External cardiotocography (CTG) was performed intermittently (every 30 minutes) to assess the fetal well-being and the uterine contractions. Once the woman started to have efficient contractions (3-4 contractions during 10 minutes), cervix dilated 3 to 4 cm and the patient started to feel pain, no more misoprostol was given.

A Foley catheter was inserted as a full bladder may interfere with fetal head descent and it was a way of assessment of the patient degree of hydration. Continuous CTG tracing was done and vaginal examination was repeated every 2 hours to assess the progress of labour. Amniotomy was done once the patient reached 5 cm as a mean of accelerating the progress of labour. All data

were registered in a portogram to follow the progress.

When oxytocin augmentation was required, a minimum interval of six hours was recommended after the last misoprostol dose. However, augmentation with oxytocin was not used in this study except if the patient did not experience regular uterine contractions during the 1<sup>st</sup> hour following amniotomy. Oxytocin was used mainly during the second stage of labour.

All data were properly collected, tabulated and statistically analyzed using computer program SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) release 25 for Microsoft Windows. Data were statistically described in terms of mean  $\pm$  standard deviation, or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups was done using Student t-test for independent samples in comparing normally distributed data. Accuracy was represented using the terms sensitivity and specificity. Receiver operator characteristic (ROC) analysis was used to determine the optimum cut off value for the studied diagnostic markers. P values less than 0.05 was considered statistically significant.

## Results

This study involved 100 women that fulfil the inclusion criteria. Regarding the patient characteristics, the mean  $\pm$  SD for age and gestational age for all participants were  $29.65 \pm 2.63$  (in years) and  $39.06 \pm 0.75$  (in weeks) respectively. There were 74 primigravida women and 26 second gravida women.

Successful induction using vaginal misoprostol was approved in our study when the patient reached the second stage of labour (fully dilated cervix) without fetal or maternal distress. About 92 women had successful induction of labour and reached the second stage of labour (group 1) while the remaining eight women had failed induction (group 2). Among group 1, 89 cases ended by successful vaginal delivery and only three women failed to deliver vaginally and delivered by CS due to arrest of fetal head descent despite fully dilated cervix, as the trial of instrumental delivery was not an option in our study.

The BMI of all women was  $29.6 \pm 3.72$ , and only 4% of them had normal weight, 49% were overweight, 38% were class I obesity and 9% were class II obesity. This diversity in BMI did not affect the success of labour induction. As regards the modified Bishop score, 4% of women had score 0, 11% had score 1, 2% had score 2, 44% had score 3, and 21% had score 4. The modified Bishop score showed a significant statistical difference. As regards the transvaginal cervical length, 13% of women had cervical length  $\leq 2$  cm, 61% had cervical length 2.1-3 cm, and 26% had cervical length  $>3$  cm. The transvaginal cervical length showed a significant statistical difference as shown in table 1.

Figure 1 shows that using the modified bishop score 2 as a cutoff value showed sensitivity 89.1%, and specificity 62.5% while using the transvaginal cervical length 2.65 as a cutoff value showed sensitivity 72.8% and specificity 100%.

**Table 1: Comparison between both groups as regards age, gestational age, BMI, modified Bishop score, and transvaginal cervical length:**

	Successful Induction (Group 1, n=92)	Failed Induction (Group 2, n=8)	P-value
Age (in years)	$29.67 \pm 2.64$	$29.38 \pm 2.67$	0.760#
Gestational age (in weeks)	$39.07 \pm 0.77$	$39 \pm 0.54$	0.757#
BMI	$29.79 \pm 3.6$	$27.49 \pm 4.67$	0.211#
Modified Bishop score	$2.77 \pm 0.99$	$1.5 \pm 1.07$	<0.001*
Transvaginal cervical length	$2.46 \pm 0.47$	$3.34 \pm 0.26$	<0.001*

Normally distributed variables are represented as mean  $\pm$  SD and paired t-test was used

#: No significant difference (P-value  $> 0.05$ )

\*: Highly significant difference (P-value < 0.001)

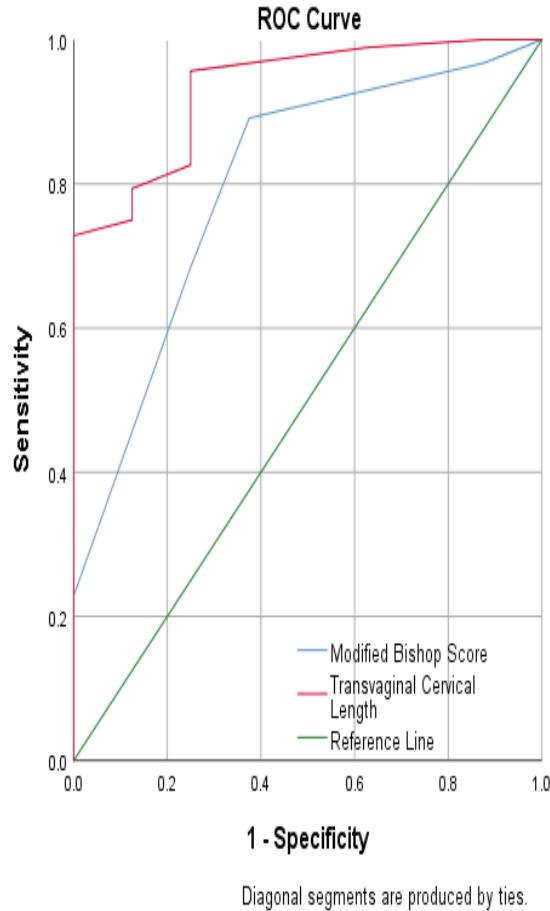


Figure 1: ROC curve of modified Bishop score and transvaginal cervical length

## Discussion

The idea of our study was to determine the proper criteria of the candidate, which can go for successful induction of labour, and avoid waste of time or risky trial for induction of labour if the candidate is better to go for caesarean

section from the first assessment.

We had chosen 100 women of smooth antenatal course, no medical comorbidity, with singleton pregnancy of cephalic presentation and intact fetal membranes. Counseling was in details. We identified 3 parameters from each patient (BMI, transvaginal cervical length and modified Bishop score) before starting the induction by vaginal misoprostol. Each patient was under close monitoring using CTG tracing to follow the progress of labour. We had 92% success of induction.

The choice of vaginal misoprostol for induction agreed with Sareen who conducted a study on term patients by vaginal misoprostol 50 mcg. He concluded that the use of misoprostol showed an evident decrease

in the time to the delivery of the baby following using the insert, without causing harms to him or changing in the number of caesarean sections<sup>6</sup>. Besides, Danielian used the misoprostol vaginal insert as a method of induction in his study and put down a conclusion that misoprostol with a dose 50 µg inserted in the vagina is more effective than 1 mg dinoprostone vaginal gel, with no apparent drawbacks on the route of delivery, or on the baby<sup>7</sup>.

Regarding each of the 3 selected parameters, the BMI didn't show in our study any statistical significance (p value=0.093) which means that it is not advised to take BMI of the patient before induction of labour as it doesn't show any impact on its success. However, the modified Bishop score and the transvaginal cervical

length showed significant statistical difference as shown previously (P value were 0.001 and <0.001 respectively).

Yousuf et al, in 2016, agreed with our previous findings, as they ran a retrospective study to assess the drawback of obesity on pregnancy and labour. They recruited data of all patients who booked in the end of their first trimester and required timed delivery during the year 2012. The candidates were divided into two groups; the first group involved those with BMI less than 23 and the other group included the cases whose BMI 23 or more. They denoted that increased weight required induction of labour due to medical condition. The study showed that the primigravida women had more chance for caesarean section(odds ratio 1.45), the length of caesarean section and loss of blood during the procedure were not obviously associated with body mass index on the higher side( $p>0.05$ ). Obesity may have some concerns in primigravida women, but it did not have major effect <sup>8</sup>.

Pevzner et al, in 2009, disagreed with our findings. Their study idea was to appraise the different features either maternal or pregnancy related that solely expect to end up in vaginal delivery and is what they meant by the target of induction of labour. The study was a secondary analysis of the data collected during the Misoprostol Vaginal Insert Trial, a multisite, double blind, randomized trial of women requiring cervical remodeling before induction of labor. The study first aim was to collect the candidate criteria who deliver by vaginal route following induction. About 72 % of the induced patients subsequently had vaginal deliveries. The parous candidates ( $P<.001$ , statistically significant), BMI below 30 ( $P<.001$ , statistically significant) and height exceeding 5'5" (statistically significant) baseline modified Bishop score of 4 ( $P=.047$ , statistically significant), and fetal weight below 4,000 g ( $P<.001$ , statistically significant) were identified as strong prognostic factors once seeking a successful induction of labor. Each of these criteria was subjected to logistic regression analysis independently. Besides that, it was perceived that the age group beyond 35 and the Hispanic race favor a successful induction in contrary to the African-American race which was linked to a higher incidence of delivery by caesarean section (P value less than 0.05 so it is statistically significant). Therefore, they affirmed lastly that the candidate 's characteristics such as BMI, parity and age are crucial parameters to be checked once looking for a successful induction of labor, and this disagreed with our findings. On the other hand, they confirmed that neonatal

birth weight is an important prognostic variable regarding the success of induction and this finding agreed with ours <sup>9</sup>.

Pandis et al., in 2001, agreed with our findings. They used to identify the rapport between the cervical length as measured by the transvaginal ultrasound as well as the bishop score. Following that, they matched these data to candidates who were induced for delivery and end up with successful vaginal delivery. This idea rose from the process that the decision to timing delivery under certain situations is overspreading. Despite that, around 20% of induced candidates end up by a caesarean delivery <sup>10</sup>.

## Conclusion

Induction of labour by vaginal misoprostol in term pregnancy is a highly promising decision. However, counselling of the woman should be based upon identification of her modified bishop score and her transvaginal cervical length. Assessment of BMI of the candidate before induction of labour is not feasible. Further studies on larger prospective studies are required to emphasize our conclusion.

**Acknowledgment:** We would like to thank our colleagues from Faculty of Medicine, Cairo University who provided insight and expertise that greatly assisted our research.

**Ethical statement:** This study was approved by the Medical Research Ethics Committee of the National Research Centre, Cairo, Egypt, and all subjects gave their informed consent.

**Consent for publication:** The manuscript has not been previously published or submitted to another journal for publication. All authors have seen and approved the manuscript being submitted.

**Conflict of Interest:** None of the authors has a financial or any conflict of interest.

**Funding:** This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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