Cervical effacement, as an independent parameter versus modified bishop score, for predicting the favorability of vaginal delivery in a primigravida at 40 weeks gestation and beyond

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ABSTRACT

Background: Dr. Edward Bishop developed the original bishop score. He concluded that elective induction in multiparous women was successful with a score > 8. Calder introduced the modified bishop score in which he replaced cervical effacement with cervical length in cms. Score of 6-12 is favourable. In this study, studied the cervical effacement/length as an independent predictor of vaginal delivery in a primigravida.

Methods: A retrospective observational study was conducted from May 2018 to January 2019. Total participants were divided into two groups on the basis of spontaneous labor and induced labor. Both the groups were assessed individually and collectively in terms of cervical effacement/length and modified bishop score. Study primary outcome was vaginal delivery. The results were reflected in terms of sensitivity, specificity, PPV and NPV. These values were compared for cervical effacement/length as well as modified bishop score and p value calculated. Also, association between modified bishop score and cervical effacement/length was established.

Results: Total number of participants included was n = 91. Those with modified bishop score > 6, 78.16% had vaginal delivery. This gave a sensitivity of 78.16%, specificity of 50%, PPV of 97.14%. Those with cervical effacement of >=50% or cervical length of <=2 cms, 78.82% had vaginal delivery. This gave a sensitivity of 78.82%, specificity of 55%, PPV of 95.71%. Thus, it had similar sensitivity, specificity, PPV to that of modified bishop score, and therefore has the same accuracy in predicting vaginal delivery. Also, 89.01% participants who had cervical effacement >= 50% had modified bishop score >= 6, reflecting the association between them.

Conclusions: Cervical effacement of >=50% or cervical length <=2 cms yielded an equivalently high predictive ability similar to modified bishop score, for spontaneous as well as induced labor. Hence, cervical effacement can be taken as an independent parameter to assess the favorability of successful vaginal delivery in a primigravida.

Keywords: Bishop score, Cervical effacement, Labor, Primigravida, Vaginal delivery

INTRODUCTION

In the 1964, Dr Edward Bishop developed a pelvic scoring system using cervical dilatation, effacement, station, consistency, and position with a range from 0 to 13. Based on clinical experience, he concluded that elective induction in multiparous women with uncomplicated pregnancies at term was successful with a score of greater than 8. Bishop was the first to attempt to quantify the physical examination of the cervix by the use of a numeric scoring system. Calder, later modified the original bishop score, which is known as modified bishop score and is more commonly used. He replaced cervical effacement which was expressed as percentage in the original bishop score with cervical length in cms. The total test score is 12. 0-5 is unfavourable and 6-12 being favourable. The original Bishop score was created on an empiric basis without modern statistical methods and the...
five components are correlated, the question remains whether all components are necessary in predicting vaginal delivery. In case, some of the components are independently associated with successful induction, then the score can be reduced to contain only those components with equivalent ability to predict a successful induction. Of all the parameters of the score, the degree of cervical dilatation was considered most important in some studies, however these studies did not differentiate between primigravidas and multigravidas. In this study, studied the cervical effacement/ length as an independent predictor of vaginal delivery in a primigravida at full term gestation. Cervical effacement precedes cervical dilatation in a primigravida, and the descent of the presenting part helps in further cervical effacement. Thus, cervical effacement may be considered to be the single most important factor to predict vaginal delivery in early labor in case of a primigravida.

**Hypothesis**

Cervical effacement of 50% or more/cervical length of ≤ 2 cm or less; can be taken as a single parameter to predict vaginal delivery. Any cervical effacement less than 50%/cervical length of >2 cm should be subjected to various methods of cervical ripening, for a successful vaginal delivery.

**METHODS**

Relevant data in terms of antenatal, intranatal data, modified bishop score, method of induction, mode of delivery, duration of first stage of labor, induction delivery interval, was collected from the patient records who were admitted in the labor room of department of obstetrics and gynecology at Yenepoya Medical College, after excluding the candidates as per exclusion criteria. Patients were selected as per inclusion criteria. A retrospective observational time-based descriptive study was conducted. Data was collected from the department of obstetrics and gynecology at Yenepoya Medical College from May 2018 to January 2019.

**Inclusion criteria**

- All primigravidas with singleton pregnancy
- Without pregnancy associated complications,
- Without any medical high-risk
- Gestational age >/= 40 weeks/0/7 days - 6/7 days
- Irrespective of their registration status (booked as well as un-booked cases) were included.

**Exclusion criteria**

- Malpresentation
- Multiple pregnancies
- Premature rupture of membranes (PROM)
- Oligohydramnios (AFI < 5)
- Any obstetrical complication
- Any surgical high risk.

The total study participants were divided into two groups. Those who had spontaneous onset of labor and those who underwent induction of labor. Further, both the groups were assessed individually and in combination in terms of cervical effacement/ cervical length and modified bishop score.

**Table 1: Modified bishop score: Calder score.**

<table>
<thead>
<tr>
<th>Cervical feature</th>
<th>Score: 0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical dilatation</td>
<td>&lt; 1 cm</td>
<td>1-2 cm</td>
<td>2-4 cm</td>
<td>&gt; 4 cm</td>
</tr>
<tr>
<td>Cervical length</td>
<td>4 cm</td>
<td>2-4 cm</td>
<td>1-2 cm</td>
<td>&lt; 1 cm</td>
</tr>
<tr>
<td>Station of presenting part</td>
<td>&lt; -3 cm</td>
<td>-2 cm</td>
<td>-1/0 cm</td>
<td>+1/+2 cm</td>
</tr>
<tr>
<td>Consistency of cervix</td>
<td>Firm</td>
<td>Average</td>
<td>Soft</td>
<td></td>
</tr>
<tr>
<td>Position of cervix</td>
<td>posterior</td>
<td>Mid position/ anterior</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


The modes of induction were noted. With modified bishop score of less than 6 and cervical effacement of less than 50%/cervical length more than 2 cm, cervical priming and induction was done using various methods such as prostaglandin E2 gel, up to 3 doses, tab misoprostol 25 microgram per vagina or 50 microgram per oral, Foley's catheter alone or followed by prostaglandin E2 gel, or oxytocin, etc. In participants, whom cervical priming was done with prostaglandins i.e. Dinoprostone gel/ misoprostol were reassessed after 6 hours and cervical changes recorded. Those who underwent Foley's induction were reassessed after 12 hours or when Foley's was expelled. Those with modified bishop score less than 6, were further primed with Dinoprostone gel and reassess after 6 hours, or started on oxytocin infusion and reassessed after 4 hours. Once the modified bishop score was favourable, labor was augmented with oxytocin infusion, if contractions were inadequate. In the group with spontaneous onset of labor, cervical score was recorded when they reported to labor room, and oxytocin infusion was started if modified bishop score was less than 6, or contractions were inadequate. In others, spontaneous progress of labor was allowed, monitored with partograph. The labor outcome was recorded in both the groups. The induction delivery interval and duration of first stage were recorded. Study
primary outcome was vaginal delivery as this is what the cervical scoring is supposed to predict successfully. The results were reflected in terms of -

- Sensitivity = true positive/(true positive + false negative)
- Specificity = true negative/(true negative + false positive)
- Positive predictive value = true positive/(true positive + false positive)
- Negative predictive value = true negative/(false negative + true negative).

These values were compared for cervical effacement/cervical length as well as modified bishop score and p value was calculated. Also, co relation between modified bishop score and cervical effacement was established.

RESULTS

Total study participants were 91 as per data collected from May 2018 to January 2019, in the age group 18 to 25 years, with gestational age 40 (0/7) to 40 (6/7) weeks. Among these 44 had spontaneous onset of labor and 47 underwent induction of labor. The results were evaluated in both the induction of labor group and spontaneous onset of labor group individually and collectively, in terms of cervical effacement and modified bishop score.

### Spontaneous onset of labor group (44)

Cervical effacement < 50% or cervical length > 2 cm

None of the participants in the spontaneous group had cervical effacement of < 50% or cervical length of > 2 cm.

<table>
<thead>
<tr>
<th>Mode of delivery</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaginal delivery</td>
<td>39</td>
<td>88.63%</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>5</td>
<td>11.36%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>44</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 2 depicts the mode of delivery in case of cervical effacement > 50% or cervical length <= 2 cm. Out of the 39 vaginal deliveries, 4 were instrumental deliveries.

### Table 3: Induction of labor group.

<table>
<thead>
<tr>
<th>Method of induction</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foley's</td>
<td>21</td>
</tr>
<tr>
<td>Prostaglandin E2 gel 1 dose</td>
<td>1</td>
</tr>
<tr>
<td>Prostaglandin E2 gel, 2/3 doses</td>
<td>4</td>
</tr>
<tr>
<td>Foley's followed by prostaglandin E2gel</td>
<td>7</td>
</tr>
<tr>
<td>oxytocin</td>
<td>3</td>
</tr>
<tr>
<td>Tab. Misoprostol 50 microgram per oral</td>
<td>1</td>
</tr>
<tr>
<td>Tab. Misoprostol 25 microgram per vagina</td>
<td>1</td>
</tr>
<tr>
<td>Foley's followed by oxytocin</td>
<td>9</td>
</tr>
</tbody>
</table>

Also, out of the 44 participants who had spontaneous onset of labor, all had cervical effacement > 50%, among them 88.63% had vaginal delivery and 11.36% underwent caesarean section.

Table 3 depicts the various methods of induction of labor, which the participants had undergone and their number.

### Table 4: Mode of delivery in case of cervical effacement <=50% or cervical length > 2 cm.

<table>
<thead>
<tr>
<th>Mode of delivery</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaginal delivery</td>
<td>3</td>
<td>50%</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>3</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Table 5: Mode of delivery in case of cervical effacement > 50% or cervical length <= 2 cm.

<table>
<thead>
<tr>
<th>Mode of delivery</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaginal delivery</td>
<td>28</td>
<td>68.29%</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>13</td>
<td>31.71%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>41</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 4 depicts the mode of delivery in case of cervical effacement <50% or cervical length > 2 cm in the induced labor group. 6 participants had cervical effacement of < 50%, out of which 3 had vaginal delivery and 3 underwent caesarean section.

Table 5 depicts mode of delivery in case of cervical effacement > 50% or cervical length <= 2 cm. 68.29% had vaginal delivery, and 31.71% had caesarean section. Out of the 28 vaginal deliveries, 2 were instrumental deliveries.

Spontaneous and induced group combined

Table 6 depicts mode of delivery in case of cervical effacement <50% or cervical length >= 2 cm in both, induced labor group and spontaneous onset of labor group taken collectively. This includes only 6 participants. 50% had vaginal delivery and 50% underwent caesarean section.

Table 7 depicts mode of delivery in case of cervical effacement > 50% or cervical length <= 2 cm in both, induced labor group and spontaneous onset of labor group taken collectively. 78.82% had vaginal delivery and 21.18% underwent caesarean section.

This gave a sensitivity of 78.82%, specificity of 55%, positive predictive value of 95.71% and negative predictive value of 14.29%.

In terms of modified bishop score (MBS)

Figure 2 depicts flow chart showing results in terms of modified bishop score in the two groups, i.e. the spontaneous onset of labor group and the induced labor group.

Spontaneous group (44)

Table 8 depicts the mode of delivery in case of modified Bishop score < 6 in the spontaneous onset of labor group. 4 participants had bishop score of < 6, out of them 2 had vaginal delivery and 2 underwent caesarean section.

Table 9 depicts the mode of delivery in case of modified Bishop score > 6 in the group with spontaneous onset of labor. Vaginal delivery occurred in 92.50% and caesarean section was performed in 7.50%. Out of the 37 vaginal deliveries, 4 were instrumental deliveries (10.81%).

Induction of labor group

Table 10 depicts the mode of delivery in case of modified Bishop score < 6 in the induced labor group, none of the participants had bishop score of < 6.
Table 11 depicts the mode of delivery in case of modified Bishop score >6 in the induced labor group. 65.95% had vaginal delivery, and 34.05% underwent caesarean section. Out of the total 31 vaginal deliveries, 2 were instrumental deliveries (6.45%).

Table 11: Mode of delivery in case of modified Bishop score > 6.

<table>
<thead>
<tr>
<th>Mode of delivery</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaginal delivery</td>
<td>31</td>
<td>65.95%</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>16</td>
<td>34.05%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>47</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Spontaneous and induced group combined

Table 12 depicts the mode of delivery in case of modified Bishop score < 6 in both, induced labor group and spontaneous onset of labor group taken collectively. A total of 4 participants were in this group. 50% underwent vaginal delivery, whereas 50% underwent caesarean section.

Table 12: Mode of delivery in case of modified Bishop score < 6.

<table>
<thead>
<tr>
<th>Mode of delivery</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaginal delivery</td>
<td>2</td>
<td>50%</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>2</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 13: Mode of delivery in case of modified Bishop score > 6 in both, induced labor group and spontaneous onset of labor group taken collectively. Out of the 87 participants, 78.16% had vaginal delivery and 21.84% underwent caesarean section. Accordingly, this gave a sensitivity of 78.16%, specificity of 50%, positive predictive value of 97.14% and negative predictive value of 9.52%.

Comparison between cervical effacement/cervical length and modified bishop score

Table 14 depicts comparison between cervical effacement/cervical length > 50% or cervical length ≤ 2 cms and modified bishop score in terms of sensitivity, specificity, positive predictive value and negative predictive value. On comparison, cervical effacement of 50% or more/cervical length < 2 cms had similar sensitivity, specificity, positive predictive value and negative predictive value as compared to that of modified bishop score, and thus has almost the same accuracy in predicting vaginal delivery as that of modified bishop score.

Table 14: Comparison between cervical effacement/cervical length and modified Bishop score.

<table>
<thead>
<tr>
<th>Cervical assessment</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Positive predictive value</th>
<th>Negative predictive value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical effacement &gt; 50% or cervical length ≤ 2 cms</td>
<td>78.82%</td>
<td>55%</td>
<td>95.71%</td>
<td>14.29%</td>
</tr>
<tr>
<td>Mod. Bishop score</td>
<td>78.16%</td>
<td>50%</td>
<td>97.14%</td>
<td>9.52%</td>
</tr>
</tbody>
</table>

Co-relation between cervical effacement/cervical length with modified bishop score

Figure 3 depicts flow chart showing results of co relation between cervical effacement/ cervical length with modified bishop score in both, the groups, i.e. the spontaneous onset of labor group and the induced labor group.

Table 15 depicts the association between cervical effacement/length and modified bishop score in both the groups collectively. Among 91 participants, 89.01% participants who had cervical effacement of > 50% or cervical length of ≤ 2 cms, had modified bishop score of ≥ 6, which further shows the association between a favourable modified bishop score and cervical effacement of > 50% or cervical length of ≤ 2 cms.
prospective study done by Reis et al of 134 women who
to predict vaginal delivery. Study findings are similar to a
cervical effacement may be taken as the only parameter
all of these settings, which suggests that in primigravida
cervical effacement in induction and spontaneous labor,

course of labor and management. We were able to test the
cervical effacement in induction and spontaneous labor,
in term pregnancies, cervical effacement as an
independent parameter performed similarly to the
modified Bishop score in predicting vaginal delivery in
all of these settings, which suggests that in primigravida
cervical effacement may be taken as the only parameter
to predict vaginal delivery. Study findings are similar to a
prospective study done by Reis et al of 134 women who
underwent induction of labor at term, in which the
cervical components of dilation and effacement were
associated with vaginal delivery within 24 hours. Using
an “abbreviated” Bishop score including dilation and
effacement only greater than 3, the predictive
characteristics of vaginal delivery (excluding 23 women
who had an emergency cesarean delivery for maternal or
fetal indications) were positive predictive value 85.5%,
negative predictive value 65.7%, which were similar to
this study. In another study, 5610 nulliparous women
with term gestation, between 37 to 41 weeks 6 days were
analyzed and a simplified bishop score was developed by
logistic regression method. The simplified bishop score
consisted of cervical effacement, cervical dilatation and
station of the presenting part. Compared with the original
Bishop score (greater than 8), the simplified Bishop score
(greater than 5) had a similar or better positive predictive
value (87.7% compared with 87.0%), negative predictive
value (31.3% compared with 29.8%), as the original
bishop score. This result is similar to this study which
also had similar sensitivity, specificity, PPV or NPV to
the modified bishop score. Another study, done by
Laughon SK et al, of 40 nulliparous and 69 multiparous
women also found that only dilation was associated with
the length of latent phase of labor after labor induction.
However, this study has taken only primigravidas into
consideration, in whom cervical effacement precedes
cervical dilatation to a much greater extent. The descent
of the presenting part further helps in effacement in case of
primigravidas. Reis et al, found that cervical dilatation and
effacement were the only components that were
significantly associated with prediction of vaginal
delivery within 24 hours so of induction. Segel et al,
investigated the relationship between fetal station on
admission for labor in nulliparous patients and
subsequent vaginal delivery. They found that lower
fetal station on admission was associated with a higher
likelihood of vaginal delivery independent of cervical
dilation. Raghuraman et al, conducted a study in which
cervical consistency and position were omitted and the

<table>
<thead>
<tr>
<th>Cervical effacement (&lt; 50%/ &gt; 2 cms)</th>
<th>Mod. Bishop score &lt; 6</th>
<th>Percentage</th>
<th>Mod. Bishop score &gt; 6</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical effacement &gt; 50%/ &lt; = 2 cms</td>
<td>4</td>
<td>4.40%</td>
<td>81</td>
<td>89.01%</td>
</tr>
</tbody>
</table>

Table 16: Duration of first stage.

<table>
<thead>
<tr>
<th>Onset of labor</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Man Whitney test p value</th>
<th>IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset of labor</td>
<td>Spontaneous</td>
<td>36</td>
<td>5.93</td>
<td>3.52</td>
<td>4.65</td>
<td>0.358</td>
</tr>
<tr>
<td>Stage of labor</td>
<td>Induced labor</td>
<td>31</td>
<td>6.47</td>
<td>3.46</td>
<td>6.00</td>
<td>Ns</td>
</tr>
</tbody>
</table>

Table 17: Induction delivery interval.

<table>
<thead>
<tr>
<th>Induction delivery interval</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Lower IQR</th>
<th>Upper IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>31</td>
<td>16.74</td>
<td>5.77</td>
<td>15.39</td>
<td>12.37</td>
<td>21.23</td>
</tr>
</tbody>
</table>

Table 15: Association between cervical effacement/ length and modified bishop score in both the groups.
predictive value of simplified bishop score, including the 3 components i.e., cervical dilatation, effacement and station of the presenting part was evaluated.\textsuperscript{11} Of the 4,733 patients admitted in spontaneous labor during the study period, 2,469 (52.2\%) women had a favorable admission SBS. Nulliparous and multiparous patients with a favorable SBS of > 5 were more likely to have a vaginal delivery [aOR 1.96, 95\% confidence intervals (CI) 1.49-2.57; aOR 1.91, 95\% CI 1.44-2.53]. Compared with dilation alone, the SBS in its entirety was associated with a higher likelihood of vaginal delivery in nulliparous. Although the addition of cervical dilatation, position or consistency, station of the presenting part may be associated with successful vaginal delivery, however the aim of this study was to identify the most important cervical parameter which could singly predict vaginal delivery in primigravidas.

CONCLUSION

To summarize, cervical effacement of >/= 50\% or cervical length </= 2 cms yielded an equivalently high predictive ability similar to modified bishop score in case of primigravidas with term gestation. The degree of cervical effacement/ cervical length as an independent parameter performed similarly to the modified Bishop score in predicting vaginal delivery in term inductions as well as in spontaneous labor at term. Given that this study is a comprising singleton, uncomplicated term gestations in primigravidas, this study findings are generalizable. Accordingly, cervical effacement can be taken as an independent parameter to assess the favourability of successful vaginal delivery in a primigravida.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES


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