Predictors of successful vaginal delivery following cesarean section
Factores predictores del éxito del parto vaginal posterior a cesárea

Martha Rondón-Tapia1, Duly Torres-Cepeda2, Jorge Mejía-Montilla3, Nadia Reyna-Villasmil4, Andreina Fernández-Ramírez5, Elizabeth La Rotta-Nuñez6, Eduardo Reyna-Villasmil7.

ABSTRACT
Objective: To determine predictors of successful vaginal delivery following primary transverse segmental cesarean section for non-recurring cause. Design: Case-control study. Institution: Hospital Central "Dr. Urquinaona", Maracaibo, Venezuela. Methods: Pregnant women with spontaneous onset of labor and history of cesarean section with transverse incision in the lower segment for non-recurring cause. The trial of labor was considered successful if it ended in vaginal delivery. Main study measures: Maternal age, parity, frequency of labor prior to previous cesarean section, gestational age at delivery, station of fetal cephalic presentation at admission, and fetal weight. Results: A total of 126 pregnant women were selected, of whom 85 (67.4%) had successful trials (vaginal delivery), while 41 (32.5%) had a failed trial. No differences in general characteristics were found between groups (p > ns). Univariate analysis showed that fetal weight equal to or less than 3,500 grams, station of fixed or engaged fetal cephalic presentation, and gestational age less than 40 weeks were significant predictors of successful trial of labor outcome (p < 0.05). Logistic regression analysis showed that fetal weight equal to or greater than 3,500 grams (p = 0.04) and station of floating - insinuated fetal cephalic presentation (p = 0.03) retained significance as predictors. Conclusion: Predictors for a successful trial of vaginal delivery following cesarean section were fetal weight less than or equal to 3,500 grams and station of fixed or engaged fetal cephalic presentation.

Key words: Vaginal birth after cesarean, Trial of labor, Fetal presentation, Fetal weight, Cesarean section

Introduction
Cesarean section is a common surgical procedure, but there are concerns that its frequency is steadily increasing in the last decades1-4. One of the main causes of the increase is elective surgery in patients with previous cesarean section1,5-7. Different investigations have focused their interest on the safety of vaginal birth after cesarean section.
(VBAC), a practice that should be encouraged to avoid the increase of pregnancy termination due to non-recurrent causes.

Several studies have shown that vaginal birth in patients with a history of cesarean section is safe\(^{(8-10)}\). Other reports have provided evidence that 60%-80% of post-cesarean trial deliveries result in successful vaginal deliveries\(^{(11,12)}\). However, caution is necessary, as complications can arise, especially in poorly equipped and understaffed obstetric care facilities\(^{(6,7)}\).

Although most patients undergoing VBAC achieve vaginal deliveries with live newborns without the use of instruments, those who fail have a higher risk of maternal morbidity and mortality compared to those undergoing repeat cesarean section\(^{(2)}\). Several investigations have attempted to establish possible predictors of successful VBAC\(^{(13,14)}\). One of the main factors for the indication of abdominal termination of pregnancy is the history of previous cesarean section. However, those cases whose indication for termination of pregnancy is failure to progress due to cephalopelvic disproportion (recurrent cause), the success rate of VBAC is higher than when the indication is a non-recurrent cause (e.g., hemorrhage of the second half of pregnancy)\(^{(15,16)}\). In addition, patients with previous cesarean sections for second stage dystocia have a lower rate of failed tests\(^{(17-19)}\). There is also evidence of increased frequency of instrumental deliveries\(^{(20)}\).

The objective of the present investigation was to determine the predictors of successful vaginal delivery following primary transverse segmental cesarean section for nonrecurrent cause. Patients were selected with a history of cesarean section by transverse incision in the lower segment for a nonrecurrent cause previously performed in the hospital, confirmed by clinical history showing indication for cesarean section, type of surgery and postoperative evolution. All the selected participants had pregnancies with singleton fetus in cephalic presentation and fetal weight estimated by ultrasound after 36 weeks less than 4,000 grams. The pelvis was assessed clinically and considered adequate by medical personnel who were independent of the study. Pregnant women with contraindications to vaginal delivery, non-reactive fetus in the non-stress test, or who refused to participate in the study were excluded. Pregnant women with successful trials were considered as cases (group A) and patients with failed trials were considered as controls (group B).

Once the diagnosis of spontaneous labor was made, a clinical evaluation was performed to establish the fetal presentation, fetal well-being parameters and availability of the patient. A peripheral venous line was cannulated and blood group and crossmatching tests were requested for the possibility of blood transfusions. The use of oxytocin to correct and increase uterine activity was left to the discretion of the attending physician. The evolution of labor was monitored using the World Health Organization parograph. Intra- and postpartum complications were managed according to the service protocol for the management of each incident.

The trial was considered successful if it ended in eutocic vaginal delivery. The predictors selected for statistical analysis were maternal age, parity, frequency of labor prior to previous cesarean section, gestational age at delivery, station of fetal cephalic presentation at admission (floating - insinuated or fixed - engaged) and fetal weight.

Data were collected, coded and analyzed using SPSS\textsuperscript{®} version 22 statistical software. Univariate analysis was used to evaluate the discriminatory capacity of each variable with successful outcome of the trial of labor (eutocic vaginal delivery). Variables with significant association at alpha 0.20 were included in a logistic regression analysis model to determine the final predictive value with a significance value of \(p < 0.05\). The results are presented as relative risk with 95\% confidence interval.
Factores predictores del éxito del parto vaginal posterior a cesárea

**Resultados**

Durante el período de estudio, 126 mujeres embarazadas fueron seleccionadas para la investigación. De todas las participantes, 85 pacientes (67.4%) tuvieron éxito en el parto vaginal posterior a cesárea (grupo A), mientras que 41 mujeres (32.5%) tuvieron cesárea debido a fracaso en el parto de trabajo (grupo B). La comparación entre las variables maternas y fetales seleccionadas se muestra en el cuadro 1. No se encontraron diferencias significativas en relación con la edad materna, número de embarazos y parto laboral antes de la cesárea previa (p = ns).

La análisis univariado mostró que el peso fetal menor o igual a 3,500 gramos, posición fetal craneal fija - enganchada y edad gestacional menor a 40 semanas presentaron valores estadísticamente significativos como predictores de éxito del VBAC (p < 0.005). El análisis de regresión logística para determinar los riesgos relativos y los intervalos de confianza del 95% mostraron que únicamente el peso fetal menor o igual a 3,500 gramos (p = 0.04) y la posición fija o enganchada craneal fetal fueron predictores significativos de parto vaginal exitoso después de una cesárea.

**Discusión**

El VBAC es deseable; en consecuencia, los resultados de este estudio y otras investigaciones previas han mostrado resultados exitosos y seguros\(^{(3,6,9-12)}\). El propósito de nuestro estudio fue identificar factores que incrementen la tasa de éxito y reduzcan la morbimortalidad materna y perinatal, que podrían complicar el parto laboral resultante en pacientes con cesáreas previas.

De las variables maternas y fetales estudiadas, únicamente el peso fetal mayor o igual a 3,500 gramos y la posición craneal flotante o insinuada continúan siendo predictores. Estos hallazgos eran esperados, ya que ambos parámetros se relacionan con el espacio de relación entre el feto y la dimensión del pélvis. Los fetos con pesos mayores a 3,500 gramos son más likely a generar displasia o disproporción craniales o volumen, que son dos de las principales indicaciones para la cesárea\(^{(3,5)}\).

El rate de VBAC en esta investigación fue del 67.4%, que se encuentra dentro del rango sugerido de 60%-80% y es ligeramente mayor que el encontrado en estudios previos\(^{(6,8-12)}\). Las diferencias observadas en los reportes previos pueden reflejar la disposición del espacio fetal y de la capacidad del pélvis. Los pesos fetales superiores a 3,500 gramos son más propensos a producir cefalopelvic disproportion o dystocia de volumen, que son dos de las principales indicaciones para la cesárea\(^{(3,5)}\).

**Cuadro 1. Asociación entre variables maternofetales y parto vaginal después de una cesárea.**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Grupo A (Casos)</th>
<th>Grupo B (Controles)</th>
<th>p</th>
<th>Relative risk</th>
<th>95% confianza interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age, años</td>
<td>27.4 +/- 5.1</td>
<td>29.4 +/- 5.3</td>
<td>0.641</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Number of pregnancies</td>
<td>19 +/- 12</td>
<td>18 +/- 12</td>
<td>0.459</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Labor before first cesarean, n (%)</td>
<td>59 (69.4)</td>
<td>18 (47.4)</td>
<td>0.031</td>
<td>2.52</td>
<td>1.02 - 5.98</td>
</tr>
<tr>
<td>Gestational age, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 37 weeks</td>
<td>26 (30.6)</td>
<td>10 (26.3)</td>
<td>0.115</td>
<td>1.16</td>
<td>0.64 - 2.20</td>
</tr>
<tr>
<td>37 to 40 weeks</td>
<td>48 (56.5)</td>
<td>16 (42.1)</td>
<td>Reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 40 weeks</td>
<td>11 (12.9)</td>
<td>12 (31.6)</td>
<td>0.045</td>
<td>3.46</td>
<td>1.05 - 11.54</td>
</tr>
<tr>
<td>Station of fetal cephalic presentation</td>
<td>47 (55.3)</td>
<td>30 (78.9)</td>
<td>Reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floating or insinuated</td>
<td>38 (44.7)</td>
<td>8 (21.1)</td>
<td>0.021</td>
<td>0.337</td>
<td>0.121 - 0.865</td>
</tr>
<tr>
<td>Newborn weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over 3500 grams</td>
<td>33 (38.8)</td>
<td>24 (63.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal or less than 3500 grams</td>
<td>52 (61.2)</td>
<td>14 (36.8)</td>
<td>0.026</td>
<td>2.70</td>
<td>1.14 - 6.44</td>
</tr>
</tbody>
</table>

**Cuadro 2. Predictores de éxito del parto vaginal después de una cesárea.**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>p</th>
<th>Relative risk</th>
<th>95% confianza interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth weight equal or greater than 3500 grams</td>
<td>0.04</td>
<td>184</td>
<td>1.69 - 256</td>
</tr>
<tr>
<td>Station of floating or insinuated fetal cephalic presentation</td>
<td>0.03</td>
<td>154</td>
<td>1.30 - 219</td>
</tr>
</tbody>
</table>
effects of several factors. First, the predictors used (observation, patient selection and surveillance) in this study were strictly controlled. Information obtained from medical records on the characteristics of primary cesarean section was also controlled to avoid a confounding effect on the research results. On the other hand, those institutions that perform this type of post-delivery trial on all patients with previous cesarean section are likely to have lower success rates.

The station of the fetal cephalic presentation represents the relationship between the fetus and the pelvis. The advancement of the floating or insinuated fetal cephalic presentation reflects the adequacy of the pelvic inlet and the median strait, so it was not surprising that most patients with the extent of the fixed or engaged fetal presentation progressed to vaginal delivery.

It is noteworthy that the phrase, ‘once a cesarean, always a cesarean’ dates back to an article entitled ‘conservatism in obstetrics’ published in 1916. Although cesarean section was rarely performed at that time, the purpose was to call attention to physicians to avoid performing unnecessary cesarean sections. In that article, cesarean section was classified as ‘a radical obstetric surgery’ and suggested to those physicians performing it that they should determine the best possible obstetric practice to avoid having to resort to it. This famous sentence appeared in the final paragraph and was clearly intended to emphasize the risks of primary cesarean section, communicating the message that a repeat procedure might be necessary. Interestingly, the article noted that there were several exceptions to the rule, as one of the patients had three unincised uterine incisions other than transverse or arcuate. The station of the fetal cephalic presentation (Kerr’s) was introduced a few years later.

There are reports that VBAC can be successful in more than 60% of trials. However, these success rates may result from the inclusion of well-selected patient groups, and the exact number of pregnant women undergoing trial of labor is unknown. Successful VBAC is associated with lower morbidity (fewer blood transfusions, postpartum infections, and hysterectomies) compared with repeat surgery.

Although the results of this study indicate the high success rate of the BVAC trial, it is necessary to perform monitoring close to delivery and to have emergency ward availability to avoid complications such as uterine rupture, which causes both maternal and perinatal complications. Other common complications include excessive bleeding requiring surgical exploration, hysterectomy and risk of bladder injury, in addition to the possibility of acute fetal distress. Although uterine rupture is the most feared complication of post cesarean delivery, most studies report rates of symptomatic uterine rupture close to 1%. However, there are other reports indicating frequencies well below 1%. The group of patients who present vaginal deliveries prior to cesarean section with transverse incision in the uterine segment and without contraindications for vaginal delivery are candidates for a trial of labor, which is not applicable to patients with two or more surgeries, since the risk of uterine rupture is multiplied. It is also necessary to consider that the success rate may be higher in patients whose causes of cesarean section are iterative (e.g., fetal distress or breech presentation). Patients with a history of uterine incisions other than transverse or arcuate are also not candidates for VBAC.

Conclusion

The results of the present investigation demonstrate that the predictors for a successful trial of postcesarean vaginal delivery are fetal weight less than or equal to 3,500 grams and station of fixed or engaged fetal cephalic presentation. However, further research is needed to study the utility of the identified factors along with other clinical or imaging factors, in other trials. The most important aspect of this research is that the identified predictors can be measured at the time of delivery.

Referencias bibliográficas


Factores predictores del éxito del parto vaginal posterior a cesárea


