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Statement of ethical issues

Acknowledgment of authorship: All authors declare that they have contributed to the idea, study design, data collection, data analysis and interpretation, critical review of the intellectual content, and final approval of the manuscript we are submitting.

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Predictors of successful vaginal delivery following cesarean section

Factores predictores del éxito del parto vaginal posterior a cesárea

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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-recurrent 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 station, Fetal weight, Cesarean section

RESUMEN

Objetivo. Determinar los predictores del éxito del parto vaginal posterior a cesárea segmentaria transversal primaria por causa no recurrente. Diseño. Estudio de casos y controles. Institución: Hospital Central "Dr. Urquinaona", Maracaibo, Venezuela. Métodos. Gestantes con inicio espontáneo del trabajo de parto y antecedentes de cesárea con incisión transversal en el segmento inferior por causa no iterativa. La prueba de parto fue considerada exitosa si terminaba en parto vaginal. Principales medidas de estudio. Edad materna, paridad, frecuencia de trabajo de parto previo a la cesárea anterior, edad gestacional al momento del parto, estación de la presentación cefálica fetal al ingreso y peso fetal. Resultados. Se seleccionó 126 gestantes, de las cuales 85 (67,4%) tuvieron pruebas exitosas (parto vaginal), mientras que 41 (32,5%) tuvieron prueba fallida. No se encontraron diferencias en las características generales entre los grupos (p = ns). El análisis univariante mostró que el peso fetal igual o menor de 3,500 gramos, la estación de la presentación cefálica fetal fija o encajada y la edad gestacional menor de 40 semanas fueron predictores significativos del resultado exitoso de la prueba de parto ($p < 0,05$). El análisis de regresión logística demostró que el peso fetal igual o mayor de 3,500 gramos ($p = 0,04$) y la estación de la presentación cefálica fetal flotante - insinuada ($p = 0,03$) conservaron importancia como predictores. Conclusión. Los predictores para una prueba exitosa de parto vaginal posterior a cesárea fueron peso fetal menor o igual a 3,500 gramos y la estación de la presentación cefálica fetal fija o encajada.

Palabra clave. Parto vaginal después de cesárea, Prueba de parto, Presentación fetal, Peso fetal, Cesárea

Introduction

Cesarean section is a common surgical procedure, but there are concerns that its frequency is steadily increasing in the last decades[1-4]. One of the main causes of the increase is elective surgery in patients with previous cesarean section[3,5-7]. 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[7]. 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.

Methods

A case-control study was performed with participants who were prospectively selected for VBAC trials among pregnant women who attended the high-risk prenatal consultation of the Central Hospital "Dr. Urquinaona", Maracaibo, Venezuela, between January 2019 and December 2021. The research protocol was approved by the hospital's Ethics Committee and written consent was obtained from all participants included in the study after a detailed explanation of the research objectives.

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 partograph. 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 euthocic 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® version 22 statistical software. Univariate analysis was used to evaluate the discriminatory capacity of each variable with successful outcome of the trial of labor (euthocic 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.

Results

During the study period, 126 pregnant women were selected for the investigation. Of all participants, 85 patients (67.4%) had successful trial of labor following cesarean section (group A), while 41 women (32.5%) underwent cesarean section due to failed trial of labor (group B). The comparison between the selected maternal and fetal variables between the groups is shown in Table 1. No significant differences were found in relation to maternal age, number of pregnancies and labor before previous cesarean section (p = ns).

Univariate analysis showed that fetal weight less than or equal to 3,500 grams, station of fetal cephalic presentation fixed - engaged and gestational age less than 40 weeks presented statistically significant values as predictors of successful VBAC ($p < 0.005$). Logistic regression analysis to determine relative risks and 95% confidence intervals showed that only birth weight less than or equal to 3,500 grams ($p = 0.04$) and station of fixed or engaged fetal cephalic presentation ($p = 0.03$) were significant predictors of successful vaginal birth after a cesarean section.

Discussion

VBAC is desirable; moreover, the results of this study and other previous research have shown successful and safe outcomes[3,6,9-12]. The purpose of our study was to identify factors that increase the success rate and reduce maternal and perinatal morbidity and mortality, which could complicate the resulting trial of labor in patients with previous cesarean section.

Of the maternal and fetal variables studied that could influence successful VBAC, only fetal weight greater than or equal to 3,500 grams and the floating or insinuated fetal cephalic presentation station continued to be predictors. These findings are expected, as both parameters are related to the relationship between the fetus and pelvic capacity. Fetal weights greater than 3,500 grams are associated with higher cesarean section rates[3]. Therefore, it is not surprising that fetal weights below this value were associated with successful VBAC. Obviously, the smaller the fetal size, the greater the ease with which it passes through a normal-sized pelvis. Those fetuses with weights greater than 3,500 grams are more likely to produce cephalopelvic disproportion or volume dystocia, which are two of the main indications for cesarean section[3,5].

The BVAC rate in this investigation was 67.4%, which places it within the suggested range 60%-80% and is slightly higher than that found in previous investigations[6,8-12]. The differences observed in previous reports may reflect the

Table 1. Association between maternal-neonatal variables and vaginal birth after cesarean section test success.

	Group A (Cases) n = 85	Group B (Controls) n = 38	*p*	Relative risk	95% confidence interval
Maternal age, years	27.4 +/- 5.1	29.4 +/- 5.3	0.641	---	----
Number of pregnancies	1.9 +/- 1.2	1.8 +/- 1.2	0.459	---	---
Labor before first cesarean section, n (%)	59 (69.4)	18 (47.4)	0.031	2.52	1.02 - 5.98
Gestational age, n (%)					
Less than 37 weeks	26 (30.6)	10 (26.3)	0.115	1.16	0.64 - 2.20
37 to 40 weeks	48 (56.5)	16 (42.1)	Reference		
More than 40 weeks	11 (12.9)	12 (31.6)	0.045	3.46	1.05 - 11.54
Station of fetal cephalic presentation					
Floating or insinuated	47 (55.3)	30 (78.9)	Reference		
Fixed or engaged	38 (44.7)	8 (21.1)	0.021	0.337	0.121 - 0.865
Newborn weight					
Over 3,500 grams	33 (38.8)	24 (63.2)			
Equal or less than 3,500 grams	52 (61.2)	14 (36.8)	0.026	2.70	1.14 - 6.44

Table 2. Predictors of success of vaginal birth after cesarean section.

Predictor	*p*	Relative risk	95% confidence interval
Birth weight equal to or greater than 3,500 grams	0.04	1.84	1.69 - 2.56
Station of floating or insinuated fetal cephalic presentation	0.03	1.54	1.30 – 2.19

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[21], 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[22]. 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 uncomplicated vaginal deliveries following cesarean section. This is remarkable, given that vertical uterine incisions were the standard at the time. The transverse arched (or Kerr's) uterine incision would be introduced a few years later[23].

There are reports that VBAC can be successful in more than 60% of trials[24]. 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[25].

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[6]. Other common complications include excessive bleeding requiring surgical exploration, hysterectomy and risk of bladder injury, in addition to the possibility of acute fetal distress[26]. 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% [27].

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[28]. 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.

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