ORIGINAL RESEARCH

RISK OF NEONATAL HOSPITALIZATION ASSOCIATED TO DELIVERY BY CESAREAN SECTION IN A HIGH COMPLEXITY CLINIC IN BOGOTÁ, COLOMBIA, 2018

Riesgo de hospitalización del neonato asociado a la cesárea en una institución de alta complejidad en Bogotá, Colombia, 2018

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ABSTRACT

Objective: To evaluate the association between cesarean delivery and hospitalization of the newborn and describe the indications for cesarean according to Robson's groups in the obstetrics service of a highly complex general institution.

Materials and methods: Cross-sectional study. All births occurred between March and July 2018 in a high complexity general teaching hospital in Bogotá, Colombia were included, by consecutive sampling up to a sample size of 1040 pregnant women. The frequency of caesarean section, indications, neonatal outcomes for each Robson group, and the risk of neonatal hospitalization are described using the crude and adjusted odds ratio (OR) using multivariate analysis.

Results: 1,493 births were included, of which 539 (36.3%) were by cesarean section. Women with a history of uterine scar scheduled for elective caesarean section and those hospitalized for induction provide the majority of caesarean sections. The main indications for cesarean section were suspicion of unsatisfactory fetal status and prolonged labor. Adjusted for birth weight, caesarean section increased the overall risk of neonatal hospitalization (adjusted OR [aOR] = 2,2; IC 99%: 1,3-3,7).

Conclusions: There are groups of Robson susceptible of intervention to decrease the rate of caesarean sections due to the suspicion of unsatisfactory fetal status and prolongation of labor. An association was found between cesarean delivery and subsequent neonatal hospitalization. Randomized controlled studies are required to determine the benefit of the strategies to reduce cesarean section rates and evaluate the association found.

Keywords: Cesarean section; delivery; obstetric; classification; care; neonatal intensive; risk factors; hospitalization.

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RESUMEN

Objetivo: evaluar la asociación entre parto por cesárea y hospitalización del neonato, y describir las indicaciones de cesárea según los grupos de Robson en el servicio de obstetricia de una institución general de alta complejidad.

Materiales y métodos: estudio de corte transversal. Se incluyeron todos los nacimientos ocurridos entre marzo y julio de 2018 en un hospital general de enseñanza de alta complejidad en Bogotá, Colombia, mediante muestreo consecutivo. Tamaño muestral de 1040 gestantes. Se describen la frecuencia de cesárea, las indicaciones, los resultados neonatales por cada grupo de Robson y el riesgo de hospitalización neonatal por medio del *odds ratio* (OR) crudo y crudo y ajustado por análisis multivariado.

Resultados: se incluyeron 1493 nacimientos, de los cuales 539 (36,3 %) fueron por cesárea. Las mujeres con antecedente de cicatriz uterina, programadas para cesárea electiva y las hospitalizadas para inducción aportan la mayoría de cesáreas. Las principales indicaciones para esta intervención fueron sospecha de estado fetal insatisfactorio y alteraciones del trabajo de parto. Ajustado por peso al nacer, la cesárea incrementó el riesgo global de hospitalización del neonato (OR ajustado [ORa] = 2,2; IC 99 %: 1,3-3,7).

Conclusiones: en la institución se identificaron grupos de Robson susceptibles de intervención para disminuir la tasa de cesáreas ante la sospecha de estado fetal insatisfactorio y prolongación del trabajo de parto. Se encontró una asociación entre el parto por cesárea y la posterior hospitalización del recién nacido. Se requieren estudios controlados aleatorizados que determinen el beneficio de las estrategias para reducir la tasa de cesárea y validar la asociación encontrada.

Palabras clave: cesárea; parto obstétrico; clasificación; cuidado intensivo neonatal; factores de riesgo; hospitalización.

INTRODUCTION

When there are clear indications, cesarean section is one of the main surgical interventions performed throughout the world in order to reduce maternal and perinatal morbidity and mortality. In 1985, the World Health Organization (WHO) established the ideal rate for cesarean section between 10 and 15 for every 100 births (1). However, its reported frequency has increased beyond the recommended level in the western world, to 22-32%, particularly in Latin America and the Caribbean with rates of 40% (2). In Colombia, the proportion of women undergoing cesarean section increased steadily from 25 to 46% between 1998 and 2014 (3). The increased frequency of cesarean section beyond certain ranges has been associated with a higher risk of maternal and perinatal complications, including maternal death, admission to the intensive care unit (ICU), risk of hysterectomy, need for transfusion, anesthesia and infection-related complications, albeit with a reduction in severe perineal tears and recto-vaginal fistulas (4, 5).

From the neonatal stand point, multiple studies report the association between neonatal respiratory disorders in newborns delivered by cesarean section compared to the vaginal route as a factor associated with the need for hospitalization (4-6). Likewise, the literature reports that cesarean delivery is associated with a higher risk of neonatal intensive care admission during 7 days for urgent cesarean section (odds ratio [OR] = 2.1; 95% CI: 1.8-2.6) and for elective cesarean section (OR = 1.9; 95% CI: 1.6-2.3), with increased neonatal mortality rates after discharge, both for the urgent (OR = 1.7; 95% CI: 1.3-2.2) as well as for the elective (OR = 1.9; 95% CI: 1.5-2.6) procedure (5).

The use of the Robson model, which classifies pregnant women with more than 24 weeks of gestation into 10 mutually exclusive groups according to parity, gestational age, onset of labor, fetal presenta-

tion and the presence of uterine scars (7), has been proposed in order to identify groups of pregnant women who could be subjected to interventions designed to optimize the number of cesarean deliveries and assess their effects on maternal and neonatal health (7, 8).

Moreover, the WHO proposes hospital use of the Robson model to assess, control and compare cesarean section rates among institutions or within a single institution over time, and to evaluate the effectiveness of the interventions implemented for optimizing the use of cesarean section as the mode of delivery (1). Studies regarding the application of this classification in medium and high complexity institutions in Colombia have reported that women with uterine scars and those subjected to labor induction at term account for the largest number of cesarean sections, together with preterm gestations (9, 10). However, there is a greater paucity of information regarding the indications for taking the women to cesarean section in other Robson groups and about the risk of neonatal hospitalization associated with the birth route in each of them.

The primary objective of this study was to approach the risk of neonatal hospitalization associated with abdominal birth. The secondary objectives were to describe the frequency and indications of cesarean sections according to the Robson classification, and to explore the risk of neonatal hospitalization on each of those groups in a high complexity private institution in Bogota.

MATERIALS AND METHODS

Design and population. Analytical cross-sectional study of pregnant women admitted for delivery between March and July 2018 to at Clínica Juan N. Corpas, a high complexity and undergraduate and graduate teaching institution in Bogota, Colombia. Pregnant women for whom the clinical record was not available were excluded. Consecutive sampling was used. A total sample size of 1040 patients was calculated (Epiinfor v 7.2 StatCalc) based on a

5% neonatal hospitalization probability following normal delivery, a 2.1-fold increase in the risk of neonatal hospitalization after cesarean section, a ratio of 2 vaginal deliveries for every cesarean section in prior studies (4, 5), a power of 80%, and a significance level of 0.05 (11). The sample was increased to ensure inclusion of births in each of the Robson groups and allow adjustment for the loss of information.

Procedure. Patients admitted for delivery care were identified in the electronic record and, based on it, the maternal and neonatal clinical history was reviewed in order to gather information on sociodemographic and clinical maternal and neonatal variables. Then, two researchers (LAL and LAV), working independently on the basis of this information, assigned the women to one of the 10 categories of the Robson classification, recorded the indication for cesarean section based on the International Classification of Diseases (ICD-10) and obtained information about each of the newborns. In cases where there was more than one indication, or discrepancies between the two researchers, a third reviewer (JAR) was brought in to define the main indication. Data were entered in duplicate in an Excel® matrix.

Measured variables: maternal age, marital status, place of origin, type of affiliation to the health social security system (state-subsidized, worker contribution, affiliated/not insured, special, exception), parity, gestational age at the time of delivery, presentation, gestational multiplicity, history of cesarean section or uterine scar, labor initiation (spontaneous or induced) (7, 8) and the main indication for cesarean section (according to the ICD-10). Neonatal variables included weight (grams) and size (centimeters), 5-minute Apgar score, initial destination (mother, hospitalization), and neonatal death. Given that the Robson classification divides women into mutually exclusive groups, measurements included overall cesarean proportion, contribution to overall proportion of c-sections and especific proportion of cesarean deliveries for each Robson group, medical

indications for cesarean delivery and the risk of neonatal hospitalization stratified for each Robson group.

Statistical analysis. The Stata® v12.0 software package under license of *Universidad Nacional de Colombia* was used for data analysis. Nominal qualitative variables are summarized as absolute and relative frequencies and quantitative variables are described with central trend and scatter measurements according to their distribution, using the Kolmogorov-Smirnov test. The association between the cesarean-delivered newborn hospitalization outcome compared to vaginal delivery was assessed in general and for Robson groups 1-4 and 10 by means of crude and adjusted OR, using a multiple logistic regression model in which variables were incorporated according to their clinical relevance. Significant colinearity (rho = 0,87, p < 0,001) was found between birth weight and gestational age, hence was excluded from the model

and the confidence level was corrected to 99% due to multiple comparisons.

Ethical considerations. This study was approved by the ethics committee of the *Universidad Nacional de Colombia* School of Medicine (B.CFM-0233-2018) and the research committee of Clínica Juan N. Corpas. Confidentiality, anonymity and privacy of all participant data were preserved.

RESULTS

During the time period between March and July 2018, 1497 women were delivered at Clínica Juan N. Corpas in Bogota. Of them, 1483 (99%) were included in the study and 14 were excluded because of clinical record unavailability. Of the included patients, 539 had a cesarean delivery, for an overall cesarean section proportion of 36.3%. Ten women gave birth to twins, for a total of 1493 neonates (Figure 1).

Figure 1.

Flow diagram of patients delivered at Clínica Juan N. Corpas, March-July, 2018
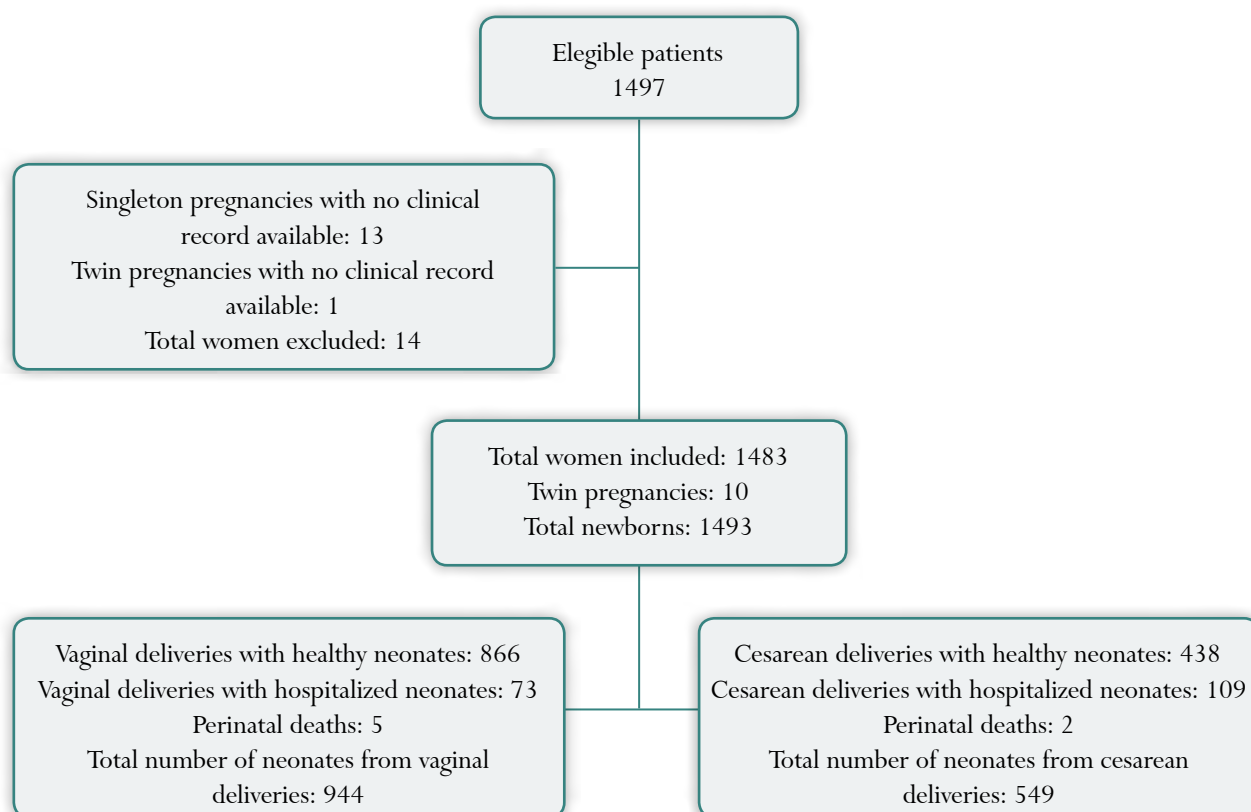
Mean participant age was 27 years (standard deviation [SD] ± 5.9), 95% of the women were urban dwellers, 46% had higher education, and 98% were affiliated to the contributive worker insurance of the Colombian General Social Security System; 50.1% were nulliparous and 9.3% had a premature delivery. The sociodemographic and clinical characteristics of all women are shown on Table 1.

As for patient distribution according to Robson groups, the group with a prior uterine scar (group 5) accounted for the largest proportion of cesarean sections (38.8%), with a specific proportion of 97.2%, followed by nulliparous women with no

labor (group 2) (21.1%), with a specific proportion of 58.8%. Although the contribution by the set of women with premature delivery was 9.4% of the total abdominal deliveries, the specific proportion was 48.1%. Specific proportions are described in Table 2.

Regarding indications for performing a cesarean section, both in nulliparous as well as in multiparous women with spontaneous term delivery in cephalic presentation, slow or absent progress of dilation and suspected unsatisfactory fetal status were the two main indications. In women in whom labor was artificially induced, the main indications were

Table 1. Sociodemographic and clinical characteristics of pregnant women delivered at Clínica Juan N. Corpas, March-July, 2018 (n = 1483 women)		
Variable	**Characteristic**	**n (%)**
Age	Average in years (SD)	27.4 (± 5.9)
Marital status	Married	255 (17.2)
	Separated/Divorced	5 (0.3)
	Single	227 (15.3)
	Free union	996 (67.2)
Schooling	Secondary	761 (51.4)
	Graduate	44 (3.0)
	Primary	53 (3.6)
	Professional	284 (19.1)
	Technical/Technological	341 (22.9)
Insurance type	Contributive	1460 (98.4)
	Exception	3 (0.2)
	Subsidized	20 (1.4)
Place of origin	Rural	64 (4.3)
	Urban	1419 (95.7)
Parity	Multiparous	740 (49.9)
	Nulliparous	743 (50.1)
Gestational age	37 weeks or more	1345 (90.7)
	Under 37 weeks	138 (9.3)

Table 2.
Cesarean section distribution and proportion by Robson groups in pregnant women delivered at Clínica Juan N. Corpas, March-July, 2018 (n = 1483 women)

Robson group	Relative group size n (%)	Proportion of cesarean deliveries by group (%)	Contribution of each group to general cesarean delivery percentage (%)
1. Nulliparous women with singleton, head presentation pregnancy, 37 weeks or more, in spontaneous labor	468 (31.5)	57/468 (12.2)	57/539 (10.6)
2. Nulliparous women with singleton, head presentation pregnancy, 37 weeks or more, with labor induction or cesarean section before the onset of labor	195 (13.1)	115/195 (58.9)	115/539 (21.1)
3. Multiparous women without prior uterine scar, with singleton pregnancy in cephalic presentation, 37 weeks of gestation or more, and spontaneous labor	372 (25.1)	23/372 (6.2)	23/539 (4.3)
4. Multiparous women without prior uterine scar, with singleton pregnancy in cephalic presentation, 37 weeks of gestation or more with induction of labor or cesarean section before the onset of labor	72 (4.9)	30/72 (41.7)	30/539 (5.6)
5. All multiparous women with a history of at least one uterine scar with 37 weeks of pregnancy or more, in cephalic presentation	214 (14.4)	208/214 (97.2)	209/539 (38.8)
6. All nulliparous women with singleton pregnancy in breach presentation	23 (1.5)	22/23 (95.6)	22/539 (4.1)
7. All multiparous women with singleton pregnancy in breach presentation, with or without prior uterine scar	16 (1.1)	16/16 (100)	16/539 (3)
8. All women with multiple pregnancies, with or without prior uterine scar	10 (0.7)	10/10 (100)	10/539 (1.8)
9. All women with singleton pregnancies in transverse or oblique presentation, with or without a prior uterine scar	7 (0.5)	7/7 (100)	7/539 (1.3)
10. All women with singleton pregnancy in cephalic presentation under 37 weeks, with or without prior uterine scar	106 (7.2)	51/106 (48.1)	51/539 (9.4)
Total	**1483 (100)**	**539/1483 (36.3)**	

suspected unsatisfactory fetal status, indications associated with prolonged duration of labor, or cephalopelvic disproportion. The main indications for cesarean section in preterm gestations were hypertensive disorders, prior uterine scar and suspected unsatisfactory fetal status (19.6%) (Table 3).

Median neonatal weight and size for all newborns were 3010 g (inter-quartile range [IQR]: 2740-3280 g) and 49 cm (IQR: 47-51cm), respectively. The group of premature neonates was found to contribute the highest number of cases with a low 5-minute Apgar and perinatal deaths. Neonatal characteristics and outcomes for each Robson group are shown in Table 4.

The highest percentage of neonatal admissions occurred in pregnancies under 37 weeks, which accounted for 62.8% of cases. Among term gestations with cephalic presentation, if was found that newborns in groups 2 and 4 (without spontaneous labor on admission) were hospitalized in basic or intensive care in a proportion of 16.9 and 13.9%, respectively, as illustrated in Table 5. There were 7 neonatal deaths, for a perinatal mortality of 5 for every 1000 births.

The bivariate analysis showed that the crude OR for neonatal hospitalization out of the total number of cesarean deliveries was 2.9 (99% CI: 1.9-4.5), as compared to neonates born through vaginal delivery. The multiple logistic regression analysis confirmed the highest risk of hospitalization among cesarean deliveries (aOR= 2.2; 99% CI: 1.3-3.7) adjusted by birth weight, maternal age and Apgar score. However, in the bivariate analysis, a higher risk of hospitalization was found for term neonates of nulliparous mothers, in cephalic presentation, with spontaneous onset of labor, born by cesarean section (crude OR =3.2; 99% CI: 1.0-11.0), as compared to neonates born by vaginal delivery. This association did not persist in the logistic regression model when adjusted by neonatal weight (aOR=3.1; IC 99% 0.7-12.9). As shown in Table 5, cesarean delivery did not result in a significant increase in the risk of neonatal hospitalization for all other Robson groups when compared to vaginal delivery. Table 5 also shows that due to to the low frequency of outcomes risks for some groups were impossible to calculate.

DISCUSSION

The results derived from this study show a proportion of cesarean deliveries that, at 36.3%, is higher at Clínica Juan N. Corpas than the WHO recommendation (1), but consistent with that reported by public institutions of similar complexity in Colombia (9, 10), and lower that the proportion reported for Colombia and for Bogota between 2016 and 2017 at 45.8 and 43,4%, respectively (12). The most frequent specific indications for cesarean delivery by Robson groups were suspected unsatisfactory fetal status, abnormal labor duration, and cephalopelvic disproportion, which are consistent with the most frequent indications reported in various studies (8-10, 13-16). An association was found between cesarean delivery and higher neonatal hospitalization in the general group (aOR = 2.2 99%/ CI: 1.3-3.7).

Just as has been reported for other institutions in this country, women with prior uterine scar accounted for more than one-third of cesarean sections performed in our institution, and the frequency of surgeries in this group is close to 100% (9, 10). In contrast, publications from different countries report cesarean section proportions of 60 and 70% for this group, when a Test of Labour after Cesarean Section (TOLAC) is incorporated in the management of these women after transverse segmental section, given the low risk of uterine rupture (0.7%) (8, 15). This intervention could be implemented at our institution in order to reduce the cesarean section rate. On the other hand, there is relative consensus regarding the indication for cesarean section in cases of breech presentation, multiple pregnancy or transverse position (17, 18) which showed specific proportions for cesarean section close to 100%. However, these groups account for only 3.8% of cesarean sections performed at our institution.

Robson group	Indications for cesarean section n (%)	n (%)
	Table 3. Indications for cesarean section by Robson group in pregnant women delivered at Clínica Juan N. Corpas, March-July, 2018 (n = 539 women)	
1	Interrupted dilation / Prolonged labor	31 (54.3)
	Suspected unsatisfactory fetal status	14 (24.6)
	Macrosomia / Cephalopelvic disproportion	8 (14)
	Abnormal fetal presentation	2 (3.5)
	Prolonged expulsive stage	1 (1.8)
	Intrauterine growth restriction	1 (1.8)
2	Suspected unsatisfactory fetal status	27 (23.7)
	Macrosomia / Cephalopelvic disproportion	18 (15.8)
	Interrupted dilation / Prolonged labor Interrupted dilation / Prolonged labor	17 (14.9)
	Failed induction	17 (14.9)
	Intra-uterine growth restriction	17 (14.9)
	Unfavorable cervix	7 (6.1)
	Hypertensive disease of pregnancy	6 (5.3)
	Prolonged expulsive stage	1 (0.9)
	Genital herpes	1 (0.9)
	Placenta previa	1 (0.9)
	Abnormal fetal presentation	1 (0.9)
	Premature rupture of membranes	1 (0.9)
3	Interrupted dilation / Prolonged labor	11 (47.8)
	Suspected unsatisfactory fetal status	5 (21.8)
	Abnormal fetal presentation	3 (13)
	Macrosomia / Cephalopelvic disproportion	2 (8.7)
	Failed induction	1 (4.3)
	Abruptio placenta	1 (4.3)
4	Macrosomia / Cephalopelvic disproportion	7 (23.3)
	Suspected unsatisfactory fetal status	7 (23.3)
	Intra-uterine growth restriction	6 (20)
	Interrupted dilation / Prolonged labor	3 (10)
	Failed induction	2 (6.7)
	Placenta previa	2 (6.7)
	Abruptio placenta	1 (3.3)
	Unfavorable cervix	1 (3,3)
	Abnormal fetal presentation	1 (3.3)

Continuation Table 3

Robson group	Indications for cesarean section n (%)	n (%)
5	History of prior uterine scar	205 (98)
	Intra-uterine growth restriction	1 (0.5)
	Suspected unsatisfactory fetal status	2 (1)
	Hypertensive disease of pregnancy	1 (0.5)
6	Abnormal fetal presentation	20 (90.9)
	Premature rupture of membranes	1 (4.5)
	Suspected unsatisfactory fetal status	1 (4.5)
7	Abnormal fetal presentation	14 (87.5)
	History of prior uterine scar	1 (6.7)
	Suspected unsatisfactory fetal status	1 (6.7)
8	Multiple pregnancy	10 (100)
9	Abnormal fetal presentation	6 (85.7)
	Premature rupture of membranes	1 (14.2)
10	Hypertensive disease of pregnancy	16 (31.3)
	History of prior uterine scar	13 (25.5)
	Suspected unsatisfactory fetal status	10 (19.6)
	Placenta previa	3 (5.9)
	Failed induction	2 (3.9)
	Intra-uterine growth restriction	2 (3.9)
	Premature rupture of membranes	2 (3.9)
	Abruptio placenta	1 (2)
	Interrupted dilation / Prolonged labor	1 (2)
	Human immunodeficiency virus infection	1 (2)
Total		539 (100)

The specific proportion of cesarean section in women with no labor, or elective induction or c-section for nulliparous and multiparous women, was higher (58 and 41.7%, respectively) than the one reported in other institutions of this country (9, 10), and much higher than that reported in other countries where this proportion is not greater than 30% (8.13-15). The main indications for cesarean section in these two groups of women (suspected unsatis-

factory fetal status and abnormal labor duration) require a new look into the strategies for monitoring fetal wellbeing, cervical maturation, labor conduction, and diagnosis of failed induction. A study carried out in 2018 in a high complexity institution in Colombia (19) reported that in none of the women in whom failed induction was diagnosed the assessment and induction of cervical maturation criteria was met (20, 21) nor the criteria for oxitocin dose,

Table 4.
Clinical characteristics and neonatal outcomes by Robson groups in pregnant women delivered at Clínica Juan N. Corpas, March-July, 2818 (n = 1493)

Robson group	Total neonates	Median weight (g) (IQR)	Median size (cm) (IQR)	APGAR < 7 (5 min) n (%)	Mortality n (%)
1	467	3050 (2830-3295)	50 (48-51)	3 (0.6)	1 (0.2)
2	195	2960 (2690-3370)	49 (48-51)	0 (0)	0 (0)
3	372	3080 (2870-3310)	50 (49-51)	0 (0)	0 (0)
4	72	2925 (2660-3190)	49 (47-51)	1 (1.4)	0 (0)
5	214	3120 (2890-3360)	50 (48-51)	0 (0)	0 (0)
6	22	2960 (2590-3180)	49 (47-50)	1 (4.3)	1 (1.3)
7	16	2890 (2455-3060)	48 (47-49)	0 (0)	0 (0)
8	20	2295 (1885-2550)	45 (43-49)	0 (0)	0 (0)
9	6	2670 (830-3020)	48 (33-49)	1 (14.3)	1 (14.3)
10	102	2240 (1780-2600)	45 (42-48)	5 (4.7)	4 (3.8)
Total	**1486**	**3010 (2740-3280)**	**49 (48-51)**	**11 (0.7)**	**7 (0.5)**

infusion times and rupture of membranes recommended by the WHO (22), resulting in a rise in the proportion of cesarean sections due to that cause. The frequency of preterm deliveries and indications for cesarean section found for that particular group (hypertensive disease of pregnancy, a history of prior uterine scar and suspected unsatisfactory fetal status) are similar in high complexity centers in the cities of Bogota, Medellin and Cartagena, which report cesarean section proportions of 43, 35 and 52%, respectively (9, 10, 16), but are higher than those reported in international studies at levels not greater than 30% (23, 24).

In this study, perinatal mortality was similar to that reported by other centers (25-27), and a higher risk of hospitalization was found for neonates born by cesarean section compared to vaginal delivery,

after controlling for birth weight, a finding that is consistent with the referenced studies. Although the multivariate analysis did no show differences in the risk of neonatal hospitalization according to the route of delivery in the group of women with labor induction or elective cesarean section with a term fetus, the literature reports that the absence of labor increases the risk of respiratory distress and hospitalization in term neonates delivered by cesarean section, while intrapartum rupture of membranes appears to diminish that risk (4-6), which also appears to decrease with steroid administration to women scheduled for cesarean section or elective induction before 39 weeks of gestation (28, 29).

One of the strengths of this study was the inclusion of a sample of 1498 patients during the four-month period, with more than 400 additional

Table 5.
Neonatal hospitalization frequency and risk by route of delivery according to Robson groups at Clínica Juan N. Corpas, March-July, 2018 (n=1486)

Robson group	Neonatal hospitalization n (%)	Neonatal hospitalization after cesarean section n (%)	Neonatal hospitalization following vaginal delivery n (%)	Crude risk of neonatal hospitalization following cesarean section OR (99% CI)	Adjusted risk of neonatal hospitalization following cesarean section aOR (99% CI)
1	24/467 (5,1)	7/57 (12.3)	17/410 (4.1)	3.2 (1.0-11.0)	3.1 (0.7-12.9) *
2	33/195 (16.9)	24/115 (21.0)	9/80 (11.2)	2.1 (0.7-6.1)	1.7 (0.4-6.5) *
3	16/372 (4.3)	0/23 (0.0)	16/349 (4.6)	0	0
4	10/72 (13.9)	7/30 (23.3)	3/42 (7.1)	3.9 (0.6-26.5)	1.8 (0.1-26.9) *
5	13/214 (6.1)	13/208 (6.3)	0/6 (0.0)	NC	NC
6	3/22 (13.6)	3/22 (13.6)	0/0 (0.0)	NC	NC
7	4/16 (25.0)	4/16 (25.0)	0/0 (0.0)	NC	NC
8	13/20 (65.0)	13/20 (65.0)	0/0 (0.0)	NC	NC
9	2/6 (33.3)	2/6 (33.3)	0/0 (0.0)	NC	NC
10	64/102 (62.8)	36/50 (72.0)	28/52 (53.8)	2.2 (0.7-6.5)	1.0 (0.2-4.7) †
Total births	182/1486 (12.2)	109/547 (19.9)	73/939 (7.7)	2.9 (1.9-4.5)	2.2 (1.3-3.7) §

OR: Odds Ratio.

NC: Not countable.

* Term pregnancies (> 37 weeks). Adjusted OR by birthweight and maternal age.

† Pregnancies < 37 weeks. Adjusted OR by birthweight and maternal age. Gestational age was excluded due to colinearity

§ Adjusted OR by birthweight and maternal age. Gestational age was excluded due to colinearity.

patients, thus reducing the risk of selection bias attributable to women excluded due to unavailable clinical records. This allows for a close estimate of cesarean indications and overall risk of neonatal hospitalization at our institution. Likewise, double data entry contributed to reducing the risk of poor quality information, and consensus among the researchers resulted in more reliable classification of the indications for cesarean section, given the variability and multiplicity of diagnoses documented in the clinical records for the determination of cesarean delivery. In terms of weaknesses, the study found a low frequency of hospitalized neonates in each Robson group, resulting in low accuracy estimates and preventing the assessment of the association between hospitalization and the delivery route in some groups. On the other hand, it was not possible to corroborate the indications for

surgical delivery together with the criteria used for diagnosing unsatisfactory fetal status, the 5-minute Apgar score, prolonged labor and cephalopelvic disproportion. There is a need to assess adherence to labor induction and conduction protocols and to the criteria for diagnosing fetal wellbeing, induction failure and labor prolongation. Additionally, the use of prospective designs is required in order to evaluate the causes of an Apgar score < 7 at 5 minutes and its association with the indication for surgical delivery, and the effect of these variables on the decision to hospitalize the neonate according to fetal weight, maternal age and neonatal diagnoses that warrant neonatal hospitalization, so as to establish neonatal safety of cesarean delivery, mainly in women with term pregnancies and cephalic presentation.

CONCLUSIONS

The Robson groups where interventions are indicated for optimizing the rate of cesarean section due to unsatisfactory fetal status and prolonged labour were identified. An association was found between cesarean delivery and neonatal hospitalization. Randomized controlled studies are needed in order to determine the benefit of the strategies that could be implemented to optimize c-section rates and to assess the association between the route of delivery and neonatal hospitalization.

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