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Universal Screening for SARS-CoV-2 in Obstetric Care: Clinical Characteristics and Maternofetal Outcomes in a Latin American High-Complexity Unit

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Abstract

The asymptomatic population's role in COVID-19 transmission poses challenges for control efforts. Pregnant women are susceptible to severe manifestations, increasing maternal and perinatal morbidity and mortality. This study describes the clinical characteristics, maternal and fetal outcomes, and our experience in universal severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) screening of pregnant women admitted to a high-complexity obstetric unit in Latin America. Of 568 pregnant women tested for SARS-CoV-2, 23 obtained a positive result. Among these patients, 17% had symptoms at admission, and 0.2% reported an epidemiological link. Pregnant women with positive were associated with an increased risk of eclampsia (16.7% vs 4.9%, $P = .014$) and acute respiratory distress (16.7% vs 4.9%, $P = .014$). In this group, 4 patients developed maternal near misses, and no maternal deaths were noted. Two early perinatal deaths occurred in the positive SARS-CoV-2 test group (2, 9.5% vs 17, 4.1%, $P = .235$). The high prevalence of asymptomatic pregnant women with SARS-CoV-2 and the adverse outcomes for those infected during pregnancy highlights the importance of universal screening upon hospital admission. This approach streamlines risk management, and enhances service structure, resource allocation, care pathways, patient management, follow-up, and overall outcomes.

Keywords

SARS-CoV-2, COVID-19, universal screening, pregnant women, pregnancy

Introduction

The rapid propagation of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection affected health systems given the variations in clinical presentation, ranging from an asymptomatic profile to severe manifestations, such as acute respiratory distress syndrome (ARDS) or pneumonia.[1,2] Therefore, transmission control is one of the primary challenges healthcare staff faces. In particular, asymptomatic or presymptomatic individuals are estimated to contribute to 48% to 62% of transmissions,[1,2] making screening based on symptoms inefficient.[3] Reverse-transcription polymerase chain reaction (RT-PCR) using upper respiratory samples via nasopharyngeal swabs exhibits the highest specificity and sensitivity to detect SARS-CoV-2. Thus, it is considered the gold standard for making the

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diagnosis and is the most widely used in clinical practice, as it can identify both symptomatic and asymptomatic individuals.[4,5]

Approximately 9 of 10 pregnant women with a positive COVID-19 test result do not report symptoms.[6] Pregnancy's immunological and physiological changes make this population more susceptible to contracting COVID-19 and developing severe symptoms; thus, pregnancy is considered a risk factor in the development and complications associated with COVID-19.[7] Moreover, asymptomatic or mildly symptomatic pregnant women have a higher risk of developing preeclampsia, premature birth, premature rupture of membrane, cesarean delivery, fetal death, maternal mortality, and perinatal morbidity than noninfected pregnant women.[8–10] Additionally, pregnant women with COVID-19 have a higher risk of intensive unit care admission, mechanical ventilation, and death than nonpregnant women of reproductive age with COVID-19.[11,12]

Universal screening based on the RT-PCR tests allows a stricter follow-up of infected pregnant women, controls the spread of COVID-19, improves biosecurity measures, and facilitates timely isolation.[13] These screening systems have improved patient risk management and strengthened the organization of the health staff in the institutions.[14] Universal screening of pregnant women has been implemented in many countries worldwide, mainly in high-income countries, protecting mothers, their babies, and healthcare workers.[15,16] However, studies of the use of similar screening systems in Latin American countries are lacking; the present study aims to describe the clinical characteristics, maternofetal outcomes, and our experience with universal screening for SARS-CoV-2 in pregnant women admitted to a high complexity obstetric unit (HCOU) in Latin America.

Methods

Design

A prospective cohort study was conducted, including pregnant women admitted to the HCOU of a quaternary care hospital in Cali, Colombia, from June to September 2020 who agreed to undergo RT-PCR for SARS-CoV-2 detection; patients who rejected the PCR test were excluded (Figure 1).

Patient Care Model

Pregnant women were admitted through the emergency room and attended by a general practitioner who classified patients according to the suspicion of COVID-19 infection based on symptoms or epidemiological links. Patients with high suspicion of COVID-19 infection were transferred to a respiratory isolation room, and those at low risk were transferred to the delivery room with the indication for contact isolation. RT-PCR testing for SARS-CoV-2 was performed by nasopharyngeal swab in all patients, regardless of suspected infection.

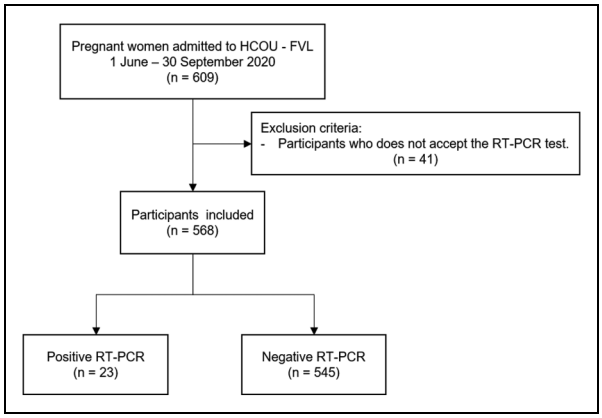

Figure 1. Flowchart of patients included based on inclusion and exclusion criteria.

Patients with positive results were hospitalized in individual rooms with air exchange as part of COVID-19 isolation protocols. Contact isolation was lifted upon receipt of negative test results. Health personnel attended all patients with the corresponding personal protective equipment following biosecurity protocols recommended by the World Health Organization (WHO).[17]

Data Collection and Statistical Analysis

Data were retrospectively collected from the medical records obtained in the institutional electronic medical record (SAP). Information on demographic characteristics, obstetric history, symptomatology, clinical and paraclinical parameters at hospital admission, pregnancy termination, maternal and perinatal complications, and management for pregnant women with positive results were included.

Medians and interquartile ranges were estimated for quantitative variables, and proportions were calculated for categorical variables. Bivariate analysis for the comparison of the quantitative variables was performed between the groups of pregnant women with positive versus negative results by conducting a Mann–Whitney *U*-test. Categorical variables were compared using a chi-square test. Fisher's exact test was used if the variable was dichotomous and had an expected frequency of < 5 in any category. A statistically significant difference was considered if the *P*-value was $< .05$. All analyses were performed in StataCorp (2015. Stata Statistical Software*:* Release 14. College Station, TX: StataCorp LP).

Ethical Approval

The Institutional Review Board approved the study protocol (Study No. 1605; Act No. 14; May 28, 2020). Written informed consent was obtained as this study was classified as low risk according to Resolution No. 008430 (1993), Article 11 Numeral A of the Ministry of Health and Social Protection of Colombia. This research was performed based

on the international recommendations of biomedical research as outlined in the Declaration of Helsinki and the CIOMS.

Results

A total of 609 pregnant women were admitted to the HCOU during the study period, and 41 patients were excluded. Thus, the total number of patients included was 568. In total, 23 patients obtained a positive result in the RT-PCR test for SARS-CoV-2, and 545 had a negative test result (Figure 1). The median age was 27 years (IQR: 23-32); most patients came from Valle del Cauca (45% from Cali and 22% from other municipalities). The median gestational age was 36.6 weeks (IQR: 33.4-38.4), and the most common comorbidities were overweight or obesity (70.4%), followed by hypertensive disorders, asthma, and diabetes (Table 1).

Maternal Clinical Characteristics and Outcomes

Regarding COVID-19 characteristics at admission, 82.6% of admitted patients with a positive result were asymptomatic; 2 (0.4%) patients reported an epidemiological link. In total, 65 (11.4%) reported some symptoms related to COVID-19, of which 4 (6.1%) had a positive PCR test result. The most common symptoms were headache (61.5%), fever (23.0%), and dyspnea (10.8%) (Table 1).

Table 1. Maternal Sociodemographics, History, and Comorbidities in a Cohort of Pregnant Women Screened for SARS-CoV-2.

		SARS-CoV-2 PCR results	
Characteristics	Total (n = 568)	Negative (n = 545)	Positive (n = 23)
Sociodemographic			
Maternal age			
Median [IQR]	27.00 [23.00, 32.00]	27.00 [23.00, 32.00]	27.00 [22.50, 31.00]
Range	(15-47)	(15-47)	(17-40)
Area of residence			
Cali	251 (44.1)	237 (43.5)	14 (60.9)
Valle del Cauca (difference to Cali)	126 (22.2)	124 (22.7)	2 (8.7)
Another department	178 (31.3)	171 (31.4)	7 (30.4)
Maternal history and comorbidities			
Gestational age Median [IQR]	36.60 [33.40, 38.40]	36.60 [33.40, 38.40]	38.10 [34.05, 39.30]
Gravidity			
1	260 (45.8)	252 (46.2)	8 (34.8)
2	184 (32.4)	176 (32.3)	8 (34.8)
≥ 3	124 (21.8)	117 (21.5)	7 (30.4)
Previous vaginal deliveries			
0	364 (64.1)	354 (65.0)	10 (43.5)
1	148 (26.1)	140 (25.7)	8 (34.8)
≥2	56 (9.8)	51 (9.4)	5 (21.7)
Previous cesarean deliveries			
0	486 (85.6)	465 (85.3)	21 (91.3)
1	67 (11.8)	65 (11.9)	2 (8.7)
≥2	15 (2.6)	15 (2.7)	0 (0.0)
Current twin pregnancy	15 (2.6)	13 (2.4)	2 (8.7)
Maternal comorbidities			
Hypertensive disorder	20 (3.5)	20 (3.7)	0 (0.0)
Asthma	18 (3.2)	17 (3.1)	1 (4.3)
Diabetes mellitus	16 (2.8)	15 (2.8)	1 (4.3)
Overweight or obesity (BMI > 25)	400 (70.4)	382 (70.1)	18 (78.2)
Characteristics related to COVID-19			
Epidemiological link	2 (0.4)	1 (0.2)	1 (0.2)
Presence of symptoms on admission	65 (11.4)	61 (11.2)	4 (17.4)
Fever	15 (2.6)	13 (2.4)	2 (8.7)
Dyspnea	7 (1.2)	6 (1.1)	1 (4.3)
Fatigue or weakness	4 (0.7)	4 (0.7)	0 (0.0)
Headache	40 (7.0)	38 (7.0)	2 (8.7)
Other[a]	6 (1.1)	5 (1.0)	1 (4.3)

Abbreviations: BMI = body mass index; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2; IQR = interquartile range.
[a]The "Other" category includes cough, chest pain, sore throat, and diarrhea.

The 3 principal hospital admission diagnoses besides a term delivery were hypertensive disorders of pregnancy, preterm labor, and premature membrane rupture without differences based on test results. Eighty-four participants required hospitalization in the intensive care unit (ICU) without a difference between the negative and positive test result groups (77, 14.1% vs 7, 30.4%, $P = .063$). Eclampsia and ARDS were significantly higher in women with positive results, and this group developed signs of clinical and paraclinical deterioration as determined by a more increased FiO_2 need and higher levels of C-reactive protein (CRP). Maternal near misses occurred in 68 (12%, $P = .624$) participants without a significant difference between groups, and only 1 (0.25, $P = 1.000$) case

Table 2. Maternal Hospitalization Characteristics Between the Negative and Positive Groups.

Characteristics	Total	SARS-CoV-2 PCR test result		*P* value
		Negative	Positive	
Diagnosis on admission				
Hypertensive disorders	149 (26.2)	139 (25.5)	10 (43.5)	.054
PPH	7 (1.2)	7 (1.3)	0 (0.0)	.582
Sepsis	1 (0.2)	1 (0.2)	0 (0.0)	.493
Preterm labor	68 (12.0)	67 (12.3)	1 (4.3)	.247
PROM	39 (6.9)	37 (6.8)	2 (8.7)	.724
Chorioamnionitis	6 (1.1)	6 (1.1)	0 (0.0)	.613
Voluntary termination of pregnancy	5 (0.9)	5 (0.9)	0 (0.0)	.132
Maternal ICU hospitalization	84 (14.8)	77 (14.1)	7 (30.4)	.063
Termination of pregnancy	469 (82.57)	447 (82.02)	22 (95.67)	.091
Abortion	9 (1.6)	9 (1.7)	0 (0.0)	.537
Vaginal delivery	232 (40.8)	221 (40.6)	11 (47.8)	.502
Cesarean	227 (40.0)	216 (39.6)	11 (47.8)	.443
Maternal complications				
ARDS	4 (6.0)	3 (4.9)	1 (16.7)	.014
PPH	50 (74.6)	46 (75.4)	4 (66.7)	.344
Eclampsia	4 (6.0)	3 (4.9)	1 (16.7)	.014
Placental abruption	5 (7.5)	5 (8.2)	0 (0.0)	.152
Endometritis	2 (3.0)	2 (3.3)	0 (0.0)	.376
DVT/PE	2 (3.0)	2 (3.3)	0 (0.0)	.376
Maternal outcomes				
Maternal Near Miss[a]	68 (12.0)	64 (11.7)	4 (17.4)	.624
Maternal death	1 (0.2)	1 (0.2)	0 (0.0)	1.000
Clinical characteristics				
Highest temperature (°C), median	36.7	36.7	36.8	.968
[IQR]	[36.5-37.0]	[36.5-37.0]	[36.2-37.3]	
Highest heart rate (lpm), median	100	100	105	.334
[IQR]	[87-110]	[87-110]	[91-112]	
Highest respiration rate (rpm), median	23	23	25	.772
[IQR]	[21-26]	[21-26]	[20-27]	
Highest FiO_2 (%), median	21	21	26.5	.064
[IQR]	[21-21]	[21-21]	[21-41]	
Lowest mean BP (mm Hg), median	70	70	74	.064
[IQR]	[63-79]	[63-80]	[70-79]	
Laboratory characteristics				
Highest CRP, median	1.5	1.41	4	.111
[IQR]	[0.6-5.23]	[0.6-5.23]	[1.43-6.92]	
Lowest PaO_2/FiO_2, median	409	409	440	.457
[IQR]	[348-438]	[348-436]	[238-438]	
Highest lactate, median	1.63	1.68	1.31	.135
[IQR]	[1.3-2.1]	[1.3-2.16]	[1.11-1.51]	

Abbreviations: PPH = postpartum hemorrhage; PROM = premature rupture of membranes; HCOU = high complexity obstetric unit; ICU = intensive care unit; ARDS = acute respiratory distress syndrome; DVT = deep vein thrombosis; PE = pulmonary embolism; BP = blood pressure; CRP = C-reactive protein; PaO_2 = partial pressure of oxygen; FiO_2 = fraction of inspired oxygen; IQR = interquartile range.

[a]According to the World Health Organization, a maternal near-miss refers to any woman who came close to death but survived a complication arising during pregnancy, childbirth, or within 42 days after pregnancy termination.[18]

of maternal death was reported in the negative result group (Table 2).

Most patients with a positive result did not require specific COVID-19 management (87%). Two patients required oxygen support; no one needed mechanical ventilation or intubation. In addition, 8.6% received corticosteroids as a treatment for COVID-19 infection, and 47.8% received antibiotics.

Neonatal Outcomes

According to neonatal characteristics, the distribution of newborn weight was similar in both groups. One neonate of a mother with a negative result exhibited a positive SARS-CoV-2 RT-PCR result. No differences in the requirement for newborn hospitalization in the Neonatal ICU (NICU) were noted between the 2 groups. However, the newborns of mothers with a positive SARS-CoV-2 PCR result required a more extended ICU stay. The most common neonatal complications in both groups were ARDS and sepsis (56.8% and 8.1%, respectively, $P = .721$). Neonatal mortality prevalence was higher in neonates from mothers with positive results (9.5%, $P = .235$) (Table 3).

Discussion

Principal Findings

The presented study described the clinical characteristics and outcomes of pregnant women with SARS-CoV-2 infection who underwent universal screening in a high-complexity obstetric unit (HCOU) in Latin America. The prevalence of COVID-19 infection was 4%, with 82.6% of these patients being asymptomatic carriers. The development of ARDS (16.7%), eclampsia (16.7%), and admission to the ICU (30.4%) were more frequently noted in those with positive results. Notably, only 3 (13.0%) patients received specific COVID-19 management. In addition, newborns of mothers with positive results had longer stays in the ICU, and no differences in complications were observed.

Results in Context

The prevalence of COVID-19 infection in pregnant patients varies across countries and observation periods. For instance, a study conducted in New York during April and March 2020 reported a COVID-19 prevalence of 37%.[19] Similarly, prevalence rates of 5% were documented in Quebec between March and July 2020,[20] as well as in Italy from April to July 2020.[13] In India, the prevalence was 12.3% between April and May 2020.[21] Our study reported a lower prevalence of COVID-19 infection. This discrepancy could be attributed to the misalignment of the pandemic's peaks in Europe and the United States with those observed in Colombia.[22,23] During our study period, Colombia was in the initial stages of COVID-19 infection due to the lockdowns and preventive measures implemented by the government,[24] enabling the country's preparedness and organizational efforts.

Our findings are in line with previous research indicating that a significant proportion of pregnant women with SARS-CoV-2 infection remain asymptomatic.[8] In most studies, the percentage of asymptomatic carriers exceeds 80% and even reaches 100% in some cases.[13,25,26] This

Table 3. Neonatal Hospitalization Characteristics Compared Between the Negative and Positive Groups.

		SARS CoV-2 PCR test result		
Characteristics	Total 429	Negative 408	Positive 21	*P* value
Newborn weight (grams)				.005
< 1000	18 (4.1)	17 (4.1)	1 (4.7)	
1000 to 1499	17 (3.9)	15 (3.6)	2 (9.5)	
1500 to 2499	78 (18.1)	75 (18.3)	3 (14.2)	
2500 to 4000	310 (72.1)	297 (72.7)	13 (61.9)	
> 4000	6 (1.4)	4 (0.9)	2 (9.5)	
Positive RT-PCR SARS-CoV-2 test	1 (0.7)	1 (0.8)	0 (0)	1.000
Neonatal ICU hospitalization	130 (32.1)	124 (32.2)	6 (30)	.924
Length of stay in ICU (days), median	6	6	10.5	.531
[IQR]	[3-17]	[3-17.5]	[6-17]	
Neonatal complications				.721
ARDS	91 (56.8)	87 (56.4)	4 (66.6)	
Sepsis	13 (8.1)	12 (7.7)	1 (16.6)	
MFC	7 (4.3)	7 (4.5)	0 (0)	
Other	49 (30.6)	48 (31.1)	1 (16.6)	
Early perinatal mortality	19 (4.3)	17 (4.1)	2 (9.5)	.235

Abbreviations: ICU = intensive care unit; ARDS = acute respiratory distress syndrome; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2; RT-PCR = Reverse-transcription polymerase chain reaction; IQR = interquartile range; MFC = microbial fuel cell; RT-PCR = reverse-transcription polymerase chain reaction; neonatal ICU = NICU.

underscores the importance of universal screening, as relying solely on symptom-based screening can miss a considerable number of cases.[5] Our results support the argument that symptom-based screening is insufficient for effective control of transmission, especially given the high percentage of asymptomatic or presymptomatic individuals contributing to disease spread.[3,4]

Despite, we do not identifying significant differences in demographic characteristics and preexisting comorbidities, many studies in pregnant and nonpregnant individuals have reported severe manifestations and complications in those with comorbidities such as obesity, hypertension, diabetes mellitus, asthma, and others.[8,27] In addition, COVID-19 infection has been shown to be more prevalent in neighborhoods with lower incomes, a higher proportion of households, higher unemployment rates, and a larger Latin population.[28,29]

A systematic review and meta-analysis found a higher risk of preeclampsia, preterm birth, and stillbirth among pregnant women with SARS-CoV-2 infection compared to those without infection.[30,31] Our study showed that women with positive COVID-19 results test had a significant risk of developing ARDS and eclampsia and experienced longer stays in the intensive care unit, which have also been considered important associated outcomes.[9,11,12] The increased incidence of ARDS and eclampsia among pregnant women with positive results further highlights the impact of COVID-19 on severe maternal morbidity.

Jerings et al demonstrated that despite a low mortality rate, patients with COVID-19 faced a higher risk of death than those not infected.[32] In our study, only one woman died who had a negative test. Fundación Valle del Lili, a fourth-level hospital, serves as a reference center in southwestern Colombia, housing the only HCOU in the region.[33] This unit has 24-hour availability of obstetrician–gynecologist specialists in intensive care and comprehensive ICU services, being a positive factor for maternal health.[9] Additionally, the use of SARS-CoV-2 screening allowed the unit to develop a risk management model and plan infrastructure, health personnel, and resources organization for patient management.

A lack of evidence of possible fetoplacental transmission was noted, as all newborns from mothers with positive test results obtained negative results. Crovetto et al[34] conducted an anti-SARS-CoV-2 IgM or IgA test on umbilical cord samples from 143 fetuses of infected mothers, yielding all negative results. This finding supports evidence that intrauterine fetal transmission is uncommon.[8] Furthermore neonates born to mothers with COVID-19 infection tend to have lower birth weights and a higher risk of NCIU admission and extended stays, confirming our findings.[9,35]

Our study revealed a case where a pregnant individual tested negative for SARS-CoV-2, while the newborn tested positive. Despite RT-PCR SARS-CoV-2 is the gold standard for identifying COVID-19 infection,[36] the variability of false-negative rates has been documented. Some systematic reviews and meta-analyses have reported that up to 54% of patients with COVID-19 infection experience an initial false-negative RT-PCR.[37,38] Additionally, it has been observed that false negatives decrease over time since infection. Therefore, conducting a second test if high clinical suspicion of infection remains is ideal.

Limits and Strengths

This study has limitations in terms of its unique scope as it was conducted in a single medical institution and its retrospective approach, which could limit the generalizability of the results. However, it offers a valuable perspective in the Latin American context and provides detailed information on clinical characteristics and maternal-fetal outcomes related to universal screening for SARS-CoV-2 in pregnant women. This study contributes to filling the knowledge gap on universal screening for COVID-19 in the Latin American context and underscores the importance of this approach in managing risk and improving outcomes for pregnant women and their babies.

Conclusions

Given the significant prevalence of asymptomatic pregnant women and the adverse outcomes among SARS-CoV-2-infected pregnant patients, universal screening for SARS-CoV-2 in delivery services allows the establishment of a risk management model, the ability to organize the resources and structure of these services and the establishment of better routes of care, management, and follow-up of these patients.

Declaration of Conflicting Interests

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