Original Article

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Quick Response Code:

Website: www.pogsjournal.org

DOI: 10.4103/pjog.pjog_16_22

Characteristics of COVID-19 positive pregnant patients admitted in a private tertiary hospital and their maternal and neonatal outcomes

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Abstract:

INTRODUCTION: The severe acute respiratory syndrome coronavirus 2 pandemic has had profound effects globally. Historical experience with previous Coronaviruses has shown increased maternal and perinatal morbidity and mortality, theoretically secondary to the physiologic changes of pregnancy. As of August 2021, the Philippines is the 23rd top country worldwide in terms of total number of cases, yet there remains to be a sparse pool of information both internationally and locally.

OBJECTIVES: This study aims to present the prevalence, clinical characteristics, as well as the neonatal, obstetric, and maternal outcomes of all pregnant women admitted in the institution who had active or previous COVID-19 infection.

METHODOLOGY: Retrospective review of data using the hospital's health information system was utilized. Within the study period, all admitted obstetric patients who had at least one positive result in a RT-PCR naso-oropharyngeal swab for SARS-CoV-2 were included in this study and categorized into: (1) symptomatic, (2) recovered, and (3) asymptomatic.

RESULTS: A total of 48 patients were included in the study, where prevalence of COVID-19 in pregnancy was 3.65%. Results showed that most patients were in the third trimester, and contrary to the non-pregnant population, majority (60.41%) did not have comorbidities. Most remained asymptomatic (33.33%) or had mild symptoms (18.75%), and underwent abdominal delivery (50%) for obstetric indications. COVID-19 status was not associated with adverse obstetric outcomes in this study population, but had significant association with preterm birth (p=0.019) and NICU admission (*P*=<0.001).

CONCLUSION: Overall, most cases were asymptomatic and had good prognosis even with the adaptations a pregnant woman undergoes. In addition, neonatal outcomes were generally good regardless of the association with preterm birth and NICU admission. Lastly, there was no appreciated evidence for vertical transmission.

Keywords:

Acute respiratory distress syndrome, cesarean section, coronavirus, coronavirus disease 2019, neonatal intensive care unit, obstetric, pandemic, pregnant women, severe acute respiratory syndrome coronavirus 2

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Submitted: 15-Apr-2022
Revised: 28-Apr-2022
Accepted: 28-Apr-2022
Published: 05-Jul-2022

Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic has had profound effects on health-care systems, societal structure, and the world economy.[1] As of August 2021, the Philippines is the 23rd top country in terms of total number of cases globally.[2] Historically, previous coronaviruses, namely the SARS and middle east respiratory syndrome (MERS), have shown more detrimental effects in the obstetric population. Epidemiological experience indicates increased maternal

*Finalist, 2021 PHILIPPINE OBSTETRICAL AND GYNECOLOGICAL SOCIETY (Foundation), INC., Annual Residents' Research Paper Contest, October 20, 2021, Online Platform: ZOOM Webinar.

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How to cite this article: Lim JA, Gonzaga ZG, Hernandez-Nazal MR. Characteristics of COVID-19 positive pregnant patients admitted in a private tertiary hospital and their maternal and neonatal outcomes. Philipp J Obstet Gynecol 2022;46:69-79.

and perinatal morbidity and mortality.[3] Physiologic changes during pregnancy make maternities not only more vulnerable to coronavirus disease 2019 infection (COVID-19) but also make the disease quicker to progress to respiratory failure and increase the likelihood for thromboembolic disease.[4,5] Sans infection, these expected changes, as well as labor and delivery make women prone to medical complications.[6]

Studies have presented varied findings. Some explain that the obstetric population is at increased risk for severe COVID-19[6] while others have shown that most are mild[7,8] to moderate[3] with the same risk factors as the general population.[9] In more recent research, it was evident that preterm labor and birth, preeclampsia, acute respiratory distress syndrome (ARDS), thrombotic events, intensive care unit (ICU) admission, and death were more common among infected pregnant patients.[6]

There has only been initial information about COVID-19 in the obstetric population. Likewise, there is scarce literature that analyzed maternities who have recovered from the infection that occurred during their pregnancy. This study presents the maternal and neonatal outcomes associated with COVID-19 during their admission in a private tertiary hospital during the first 12 months of the current pandemic. While the result of a nationwide demographic study on COVID-19 in pregnancy is still pending, the results of this study provide preliminary information on the perinatal outcomes of COVID-19 in pregnancy. Furthermore, it included not just active cases, but those who have acquired the infection antenatally.

Objectives

This study aimed to present the prevalence, demographics, clinical characteristics, as well as the maternal, obstetric, and neonatal outcomes of all pregnant women with active or previous COVID-19 infection, who were admitted in the institution during the study period. In addition, it also sought to determine the association between maternal COVID-19 status with obstetric and neonatal outcomes.

Methodology

Population and sample

Inclusion criteria

All obstetric patients who had at least one positive result in a reverse transcription-polymerase chain reaction (RT-PCR) naso-oropharyngeal swab for SARS-CoV-2 and admitted in the institution between May 1, 2020, and April 30, 2021, were included in this study. All patients involved were categorized into three groups:

1. Group 1: Symptomatic positive COVID-19 patients were the active cases, who had at least one of the symptoms in the registry tool, as well as a positive RT-PCR swab for SARS-CoV-2 on admission
2. Group 2: Recovered positive COVID-19 patients were those with the absence of any of the symptoms enumerated in the registry tool who either: (1) had at least one negative RT-PCR swab for SARS-CoV-2 on admission after being previously diagnosed with COVID-19, (2) completed 14 days of isolation from the 1st day of symptoms with no symptoms for at least the last 3 days, or (3) completed 10 days of isolation since the positive result and remained asymptomatic throughout
3. Group 3: Asymptomatic positive COVID-19 patients were the active cases, who had the absence of any of the symptoms enumerated in the registry tool with a positive RT-PCR swab for SARS-CoV-2 on admission.

Exclusion criteria

Patients who did not push through with their admission into this institution or whose data could not be retrieved were excluded from the study.

Methods

Study setting

This research was conducted in a private tertiary hospital. During this study period, the institutional policy required all obstetric patients to present an RT-PCR swab for SARS-CoV-2 done with the prescribed period. All patients who did not have a swab were required to be tested on admission.

Sampling frame and techniques

This study used purposive sampling and included all patients fulfilling the inclusion criteria within the study period.

Data collection process

After approval from the Institutional Review Board, retrospective review through the hospital's health information system was done. Additional data that were not retrievable were obtained from the attending physicians. All pertinent information of COVID-19-positive patients were placed in a Microsoft Excel form patterned after the Philippine Society of Maternal Fetal Medicine's COVID-19 registry tool, while the number of COVID-19 screen negative patients admitted were collated in a separate spreadsheet.

Data sets

Figure 1 shows the attributes included and presented according to the three aforementioned groups.

Confidentiality

The data were accessible solely to the principal investigator. Identifiers were assigned a unique code for anonymity. The spreadsheets were protected by a password only known to the principal investigator.

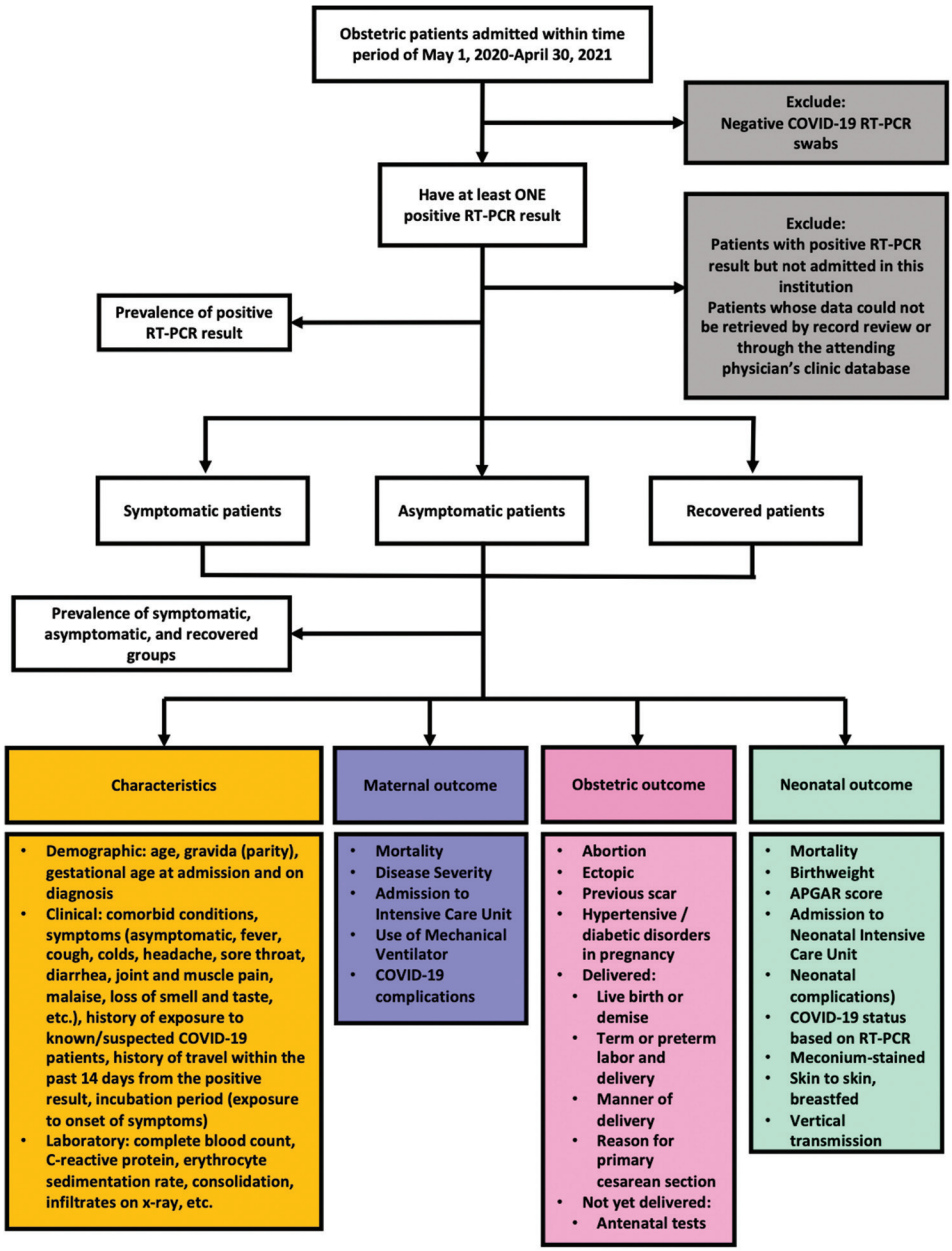

Figure 1: Process of study

Analysis

Data were analyzed in Epi Info 7 and Microsoft Excel. Descriptive statistics were presented for the categorical and continuous information. Normality was tested using Kolmogorov–Smirnov test. For associations between status and categorical characteristics, Chi-square test or Fisher's exact test was used. For continuous normal data, analysis of variance was used. For continuous nonnormal data, Mann–Whitney test was used.

Results

Between May 1, 2020, and April 30, 2021, there were 1316 obstetric admissions in this institution. From this, 1268 (96.35%) tested negative for COVID-19 through nasal-oropharyngeal RT-PCR. The prevalence of COVID-19 in the total obstetric population was 3.65%. Figure 2 shows the distribution of the population along with the severity of disease. A total of 48 patients were included in the final analysis. From this population, 29 (60.4%) had active COVID-19 infection while 19 (39.6%) had recovered from a previous infection. Of those who had active infection, 13 (44.8%) were symptomatic, and 16 (55.2%) were asymptomatic.

Demographic factors

Table 1 shows the demographic characteristics of the study participants. Maternal age of the patients ranged from 17 to

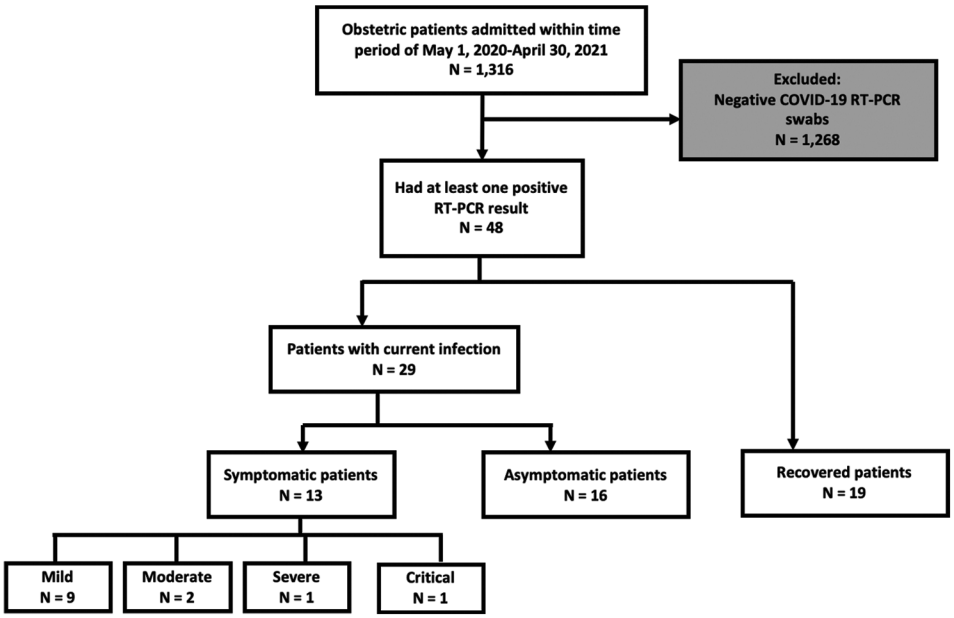

Figure 2: Distribution of study population

Table 1: Cross tabulation of demographic factors

Demographic factors (*n*=48 patients)	Asymptomatic Group 1	Recovered Group 2	Symptomatic Group 3	Total
COVID status on admission, *n* (%)	16 (33.33)	19 (39.58)	13 (27.08)	
Age, mean (SD)	39.69 (6.51)	31.47 (4.02)	34 (4.34)	31.90 (5.13)
Multiparous, *n* (%)	7 (14.58)	11 (22.92)	8 (16.67)	26 (54.17)
AOG on admission, mean (SD)	34.19 (8.46)	37.47 (2.83)	33.17 (6.71)	35.26 (6.39)

SD: Standard deviation, AOG: Age of gestation

Table 2: Characteristics of recovered COVID-19 patients

Demographic factors (*n*=19 patients)	
Factors	**Total**
AOG on positive COVID swab, median (IQR)	33 (30-37)
Severity on positive COVID swab, *n* (%)	
Asymptomatic	8 (42.11)
Mild	8 (42.11)
Moderate	3 (15.79)

SD: Standard deviation, AOG: Age of gestation

42 years with a mean of 31.9 (standard deviation [SD] 5.13). Most were multiparous (*n* = 26, 54.16%) while the remaining 22 were nulliparous (45.83%). These women were admitted in the hospital at a median gestational age of 38 completed weeks (interquartile range [IQR]: 35–39 weeks). There were two patients in their first trimester – one at eight completed weeks as a case of ectopic pregnancy and the other at 11 weeks, who eventually recovered and delivered at term.

Table 2 shows the characteristics of patients in Group 2. For the recovered patients, the median age of gestation at the diagnosis of SARS-CoV2 infection was 33 completed weeks (IQR 30–37). At the time of diagnosis, eight were asymptomatic, eight had mild disease, and three had moderate disease. Three patients were admitted at the time of their COVID-19 infection and were eventually re-admitted for delivery.

Clinical features

Table 3 shows the maternal clinical features. The mean body mass index (BMI) of all patients was 25.48 (SD 3.58). Forty-one patients (85.4%) did not report any symptoms on admission, but six (12.6%) eventually developed symptoms during their hospital stay. The most common symptoms reported were cough (*n* = 5, 10.42%), fever (*n* = 4, 8.33%), dyspnea (*n* = 4, 8.33%), nasal congestion (*n* = 3, 6.25%), myalgia (*n* = 3, 6.25%), malaise (*n* = 3, 6.25%), and anosmia (*n* = 3, 6.25%). Eight women (16.67%) reported pertinent travel history or exposure, four of whom presented with symptoms. None of the subjects had cigarette-smoking history.

Table 4 shows the associated maternal conditions. Twenty-nine (60.41%) patients had no known comorbid illnesses. The remaining commonly had hypertensive (*n* = 9, 18.75%) and diabetic disorders (*n* = 4, 8.33%), antiphospholipid antibody syndrome or recurrent

Table 3: Cross tabulation of maternal clinical features

n=48 patients	Asymptomatic Group 1	Recovered Group 2	Symptomatic Group 3	Total
BMI, mean (SD)	26.09 (3.28)	25.65 (4.38)	25.48 (3.58)	25.48 (3.58)
Temperature, mean (SD)	36.78 (0.51)	36.55 (0.42)	37.12 (0.77)	36.78 (0.59)
No symptoms on admission, *n* (%)	16 (33.33)	19 (39.58)	6* (12.50)	
Cough, *n* (%)	0	0	5 (10.42)	
Fever, *n* (%)	0	0	4 (8.33)	
Dyspnea, *n* (%)	0	0	4 (8.33)	
Nasal congestion, *n* (%)	0	0	3 (6.25)	
Myalgia, *n* (%)	0	0	3 (6.25)	
Malaise, *n* (%)	0	0	3 (6.25)	
Anosmia, *n* (%)	0	0	3 (6.25)	
Loss of taste, *n* (%)	0	0	2 (4.17)	
Sore throat, *n* (%)	0	0	1 (2.08)	
Chest pain, *n* (%)	0	0	0	
Diarrhea, *n* (%)	0	0	0	
Travel history/exposure within 2 weeks, *n* (%)	2 (4.17)	2 (4.17)	4 (8.33)	8 (16.67)
Smoking history, *n* (%)	0	0	0	

*Six patients initially presented as asymptomatic, but eventually developed symptoms during the admission. BMI: Body mass index, SD: Standard deviation

Table 4: Cross tabulation of comorbidities of the study population

n=48 patients	Asymptomatic Group 1, *n* (%)	Recovered Group 2, *n* (%)	Symptomatic Group 3, *n* (%)	Total, *n* (%)
No comorbid illness	12 (25.00)	12 (25.00)	5 (10.42)	29 (60.41)
Hypertensive disorders	3 (6.25)	2 (4.17)	4 (8.33)	9 (18.75)
Diabetic disorders	2 (4.17)	2 (4.17)	0	4 (8.33)
APAS/RPL	2 (4.17)	0	1 (2.08)	3 (6.25)
Thyroid disorders	1 (2.08)	2 (4.17)	1 (2.08)	4 (8.33)
Beta thalassemia	0	2 (4.17)	0	2 (4.17)
Bronchial asthma	0	0	2 (4.17)	2 (4.17)
Gestational trophoblastic neoplasia	0	0	1 (2.08)	1 (2.08)

APAS: Antiphospholipid antibody syndrome, RPL: Recurrent pregnancy loss

Table 5: Frequency tabulation of abnormal/elevated clinical tests

Laboratory*/radiologic parameters	Count (%)			
	Asymptomatic Group 1	Recovered Group 2	Symptomatic Group 3	Total
WBC (*n*=48)	1 (2.08)	2 (4.17)	0	3 (6.25)
Monocytes (*n*=48)	0	0	0	0
Lymphocytes (*n*=48)	0	0	0	0
Platelets (*n*=48)	0	0	0	0
Lactate dehydrogenase (*n*=8)	0	0	1 (12.50)	1
C-reactive protein (*n*=9)	1 (11.11)	0	6 (66.67)	7 (77.78)
Alanine transaminase (*n*=8)	0	0	4 (50.00)	4 (50.00)
Aspartate transaminase (*n*=7)	0	0	2 (28.57)	2 (28.57)
D-Dimer (*n*=4)	0	0	3 (75.00)	3 (75.00)
Procalcitonin (*n*=8)	0	0	2 (25.00)	2 (25.00)
Ferritin (*n*=9)	0	0	3 (33.33)	3 (33.33)
Creatinine (*n*=8)	0	0	0	0
Abnormal chest x-ray findings (*n*=11)	0	0	5 (45.45)	5 (45.45)

*Normal values based on reference ranges in pregnant women (accounting for appropriate age of gestation). WBC: White blood cell count

pregnancy loss (n = 3, 6.25%), thyroid disorders (n = 4, 8.33%), beta-thalassemia (n = 2, 4.17%), and bronchial asthma (n = 2, 4.17%), with one (2.08%) case of previous gestational trophoblastic neoplasia in remission.

Laboratory and radiologic parameters

Table 5 summarizes the laboratory and radiologic parameters of the patients based on the values of Abbassi-Ghanavati M, *et al*.[20] Complete blood count

was done on all patients. Other tests and imaging studies were done mostly in Group 3 patients.

Maternal outcome

Table 6 shows the maternal outcomes. There were 29 active cases on admission (60.42%). Most were asymptomatic (n = 16, 33.33%), nine (18.75%) had mild disease, two (4.17%) had moderate disease, one (2.08%) had severe disease, and one (2.08%) had critical disease requiring transfer to the ICU for ARDS, sepsis, and cytokine storm. The average duration of hospital admission was 3.92 days (range: 2–14 days). There was only one case of mortality. The rest (n = 47, 97.92%) were discharged stable or recovered.

Obstetric outcome

Table 7 shows the obstetric outcomes. Twenty-seven maternities (56.25%) came to the hospital in labor at term while eleven (22.92%) patients had either preterm labor or threatened preterm labor with two (4.17%) associated with preterm prelabor rupture of membranes (PPROM). Majority of the deliveries were term (n = 31, 73.81%) versus preterm (n = 11, 26.19%). Thirteen (27.08%) of these had a previous uterine scar. There were ten patients (20.83%)

Table 6: Cross tabulation of maternal outcome and maternal COVID status

Maternal outcome (n=48 patients)	Asymptomatic Group 1	Recovered Group 2	Symptomatic Group 3	Total
COVID severity during admission, *n* (%)				
Asymptomatic	16 (33.33)	0	0	
Mild	0	0	9 (18.75)	
Moderate	0	0	2 (4.17)	
Severe	0	0	1 (2.08)	
Critical	0	0	1 (2.08)	
Recovered	0	19 (39.58)	0	
Ward admission, *n* (%)	16 (33.33)	19 (39.58)	13 (27.08)	48
Days admitted in ward, mean (SD)	3 (0.52)	3.58 (1.39)	5.54 (3.84)	3.92 (2.37)
ICU admission, *n* (%)	0	0	1* (2.08)	
Days admitted in ICU	0	0	3*	
Mechanical ventilator use, *n* (%)	0	0	1* (2.08)	
Days on mechanical ventilator, *n* (%)	0	0	3* (6.25)	
COVID outcome on discharge, *n* (%)				
Stable	14 (29.17)	19 (39.58)	9 (18.75)	
Recovered/improved	2 (4.17)	0	3 (6.25)	
Expired	0	0	1 (2.08)	
Pneumonia, *n* (%)	0	0	4 (8.33)	
ARDS, *n* (%)	0	0	1* (2.08)	
Sepsis, *n* (%)	0	0	1* (2.08)	
Cytokine storm, *n* (%)	0	0	1* (2.08)	
Thromboembolism, *n* (%)	0	0	0	
Auto-immune, *n* (%)	0	0	0	
Stroke, *n* (%)	0	0	0	

*Only one patient was admitted to the ICU, required the use of a mechanical ventilator, and developed COVID-related complications. ARDS: Acute respiratory distress syndrome, ICU: Intensive care unit

Table 7: Cross tabulation of obstetric outcome and maternal COVID status

n=48 patients	Asymptomatic Group 1, *n* (%)	Recovered Group 2, *n* (%)	Symptomatic Group 3, *n* (%)	Total, *n* (%)
In labor	11 (22.92)	8 (16.67)	7 (14.58)	27 (56.25)
Preterm labor	4 (8.33)	4 (8.33)	3 (8.33)	11 (22.92)
PPROM	2 (4.17)	0	0	2 (4.17)
Previous uterine scar	3 (6.25)	6 (12.50)	4 (8.33)	13 (27.08)
Preeclampsia	2 (4.17)	0	2 (4.17)	4 (8.33)
Gestational hypertension	1 (2.08)	1 (2.08)	1 (2.08)	3 (6.25)
Chronic hypertension	0	0	2 (4.17)	2 (4.17)
Chronic hypertension with superimposed preeclampsia	0	1 (2.08)	0	1 (2.08)
Eclampsia	0	0	0	0
Gestational diabetes mellitus	2 (4.17)	2 (4.17)	0	4 (8.33)
IUGR	0	0	0	0

PPROM: Preterm prelabor rupture of membrane, IUGR: Intrauterine growth restriction

who had a form of hypertensive disorder in pregnancy, most commonly preeclampsia ($n = 4$, 8.34%). The rest had either gestational hypertension ($n = 3$, 6.25%), chronic hypertension ($n = 2$, 4.17%), and chronic hypertension with superimposed preeclampsia ($n = 1$, 2.08%). None developed eclampsia. Four patients (8.3%) had gestational diabetes mellitus, while none had overt diabetes mellitus.

On admission, 35 women underwent a cardiotocogram [Table 8]. Most ($n = 32$, 64.58%) were categorized as normal according to the International Federation of Gynecology and Obstetrics consensus guidelines on intrapartum fetal monitoring. There were three (6.25%) grouped as suspicious. While there were no pathologic tracings on admission, there was one cardiotocogram, which was subsequently read as pathologic on call necessitating an emergency primary cesarean section (2.1%).

Table 9 shows the definitive management done during admission. Forty-one patients (85.42%) delivered, six underwent medical management and one underwent total exploratory laparotomy for an ectopic pregnancy. Among the 41 patients who delivered, 24 (58.5%) underwent cesarean section, 12 of whom were primary cesarean section. The most common indication for primary cesarean section was dystocia ($n = 7$, 29.17%) [Table 10]. Only one (4.17%) underwent primary cesarean section due to her COVID-19 status. The remaining 17 patients were delivered vaginally, from whom two were assisted vaginal deliveries. There were no statistically significant associations between maternal COVID-19 status and obstetric outcomes [Table 11].

Neonatal outcomes

Table 12 shows the neonatal outcomes. Forty-two neonates were born from the 41 deliveries (one set of twin pregnancy). Of these, 23 (54.75%) were born to mothers with active infection (Group 1 and Group 3) and admitted at the neonatal ICU (NICU) with a mean length of stay of 4.5 days (range: 1–54 days). At birth, 35 neonates (83.33%) had an APGAR score of >8 at the 1st and 5th min of life. The mean birth weight was 2966.07 g (SD

Table 8: Cross tabulation of tests of fetal well-being and maternal COVID status

n=48 patients	Asymptomatic Group 1, *n* (%)	Recovered Group 2, *n* (%)	Symptomatic Group 3, *n* (%)	Total, *n* (%)
NST on admission (FIGO suspicious)	11 (22.92)	15 (31.25)	6 (12.50)	32 (66.67)
NST on admission (FIGO pathologic)	1 (2.08)	1 (2.08)	1 (2.08)	3 (6.25)
NST last* (FIGO suspicious)	0	1 (2.08)	1 (2.08)	2 (4.17)
NST last* (FIGO pathologic)	0	0	1 (2.08)	1 (2.08)
Contraction stress test	0	1 (2.08)	0	1 (2.08)
BPS 8/8	1 (2.08)	3 (6.25)	2 (4.17)	5

*Last before delivery. NST: Nonstress test, FIGO: Federation of gynecology and obstetrics, BPS: Biophysical profile score

Table 9: Cross tabulation of the definitive management during admission

Obstetric management (*n*=48 patients)	Asymptomatic Group 1, *n* (%)	Recovered Group 2, *n* (%)	Symptomatic Group 3, *n* (%)	Total, *n* (%)
Normal spontaneous vaginal delivery	4 (8.33)	6 (12.50)	5 (10.42)	15 (31.25)
Primary cesarean section	5 (10.42)	6 (12.50)	1 (2.08)	12 (25.00)
Repeat cesarean section	3 (6.25)	6 (12.50)	3 (6.25)	12 (25.00)
Medical management	1 (2.08)	1 (2.08)	4 (8.33)	6 (12.50)
Assisted vaginal delivery	2 (4.17)	0	0	2 (4.17)
Others	1* (2.08)	0	0	1 (2.08)

*Exploratory laparotomy

Table 10: Cross tabulation of the indications for cesarean section

n=24 patients	Asymptomatic Group 1, *n* (%)	Recovered Group 2, *n* (%)	Symptomatic Group 3, *n* (%)	Total, *n* (%)
Previous cesarean section	3 (12.50)	6 (25.00)	3 (12.50)	12 (50.00)
Dystocia	3 (12.50)	4 (16.67)	0	7 (29.17)
Arrest of cervical dilatation	2 (8.33)	2	0	4 (16.67)
Failure of descent	0	2 (8.33)	0	3 (12.50)
Arrest of descent	1 (4.17)	0	0	1 (4.17)
Nonreassuring fetal heart rate and pattern	0	1 (4.17)	0	1 (4.17)
Failed induction of labor	0	1 (4.17)	0	1 (4.17)
Malpresentation	1 (4.17)	0	0	1 (4.17)
Maternal condition	0	0	1 (4.17)	1 (4.17)
Maternal demand	1 (4.17)	0	0	1 (4.17)

Table 11: Association between obstetric outcomes and COVID status using Chi-square tests

Obstetric outcomes	Category	Asymptomatic Group 1		Recovered Group 2		Symptomatic Group 3		*P*
		Count	Column (%)	Count	Column (%)	Count	Column (%)	
Intrauterine growth restriction	No	16	100.0	13	100.0	18	94.7	1.000
	Yes	0	0.0	0	0.0	1	5.3	
In labor	No	5	31.3	6	46.2	11	57.9	0.289
	Yes	11	68.8	7	53.8	8	42.1	
Previous uterine scar	No	13	81.3	9	69.2	13	68.4	0.655
	Yes	3	18.8	4	30.8	6	31.6	
Hypertension disease in pregnancy	No	13	81.3	8	61.5	17	89.5	0.171
	Yes	3	18.8	5	38.5	2	10.5	
Diabetes mellitus in pregnancy	No	14	87.5	13	100.0	17	89.5	0.543
	Yes	2	12.5	0	0.0	2	10.5	
Dystocia	No	13	81.3	13	100.0	15	78.9	0.226
	Yes	3	18.8	0	0.0	4	21.1	
Preterm labor	No	10	62.5	10	76.9	15	78.9	0.559
	Yes	6	37.5	3	23.1	4	21.1	
Mode of delivery	Not delivered	1	6.3	4	30.8	1	5.3	0.396
	Vaginal delivery	6	37.5	5	38.5	7	36.8	
	Primary CS	5	31.3	1	7.7	5	26.3	
	Repeat CS	3	18.8	3	23.1	6	31.6	
	Exploratory laparotomy	1	6.3	0	0.0	0	0.0	

CS: Cesarean section

Table 12: Cross tabulation of neonatal outcome and maternal COVID status

n=42 patients	Asymptomatic Group 1	Recovered Group 2	Symptomatic Group 3	Total
COVID status of mother (%)	14 (33.33)	19 (45.24)	10 (23.81)	
NICU admission, *n* (%)	14 (33.33)	0	9 (21.43)	23 (54.76)
Days in NICU, mean (SD)	4.33 (4.42)	0.17 (0.71)	13.44 (20.36)	4.50 (10.66)
MT, mean (SD)	37.20 (2.08)	38.3 (0.84)	36.33 (3.67)	37.50 (2.24)
Term, *n* (%)	10 (23.81)	18 (42.86)	7 (16.67)	35 (83.33)
Preterm, *n* (%)	5 (11.90)	0	2 (4.76)	7 (16.67)
AGA, *n* (%)	13 (30.95)	14 (33.33)	8 (19.05)	35 (83.33)
LGA, *n* (%)	1 (2.38)	3 (7.14)	1 (2.38)	5 (11.90)
SGA, *n* (%)	1 (2.38)	1 (2.38)	0	2 (4.76)
Birth weight (g), mean (%)	2944.67 (683.17)	3106.39 (517.99)	2721.11 (812.26)	2966.07 (649.10)
APGAR 1 (<8), *n* (%)	3 (7.14)	1 (2.38)	1 (2.38)	
APGAR 5 (<8), *n* (%)	1 (2.38)	0	1 (2.38)	
Meconium, *n* (%)	4 (9.52)	1 (2.38)	0	
Skin to skin, *n* (%)	14 (33.33)	18 (42.86)	7 (16.67)	39 (92.86)
Breastfed, *n* (%)	14 (33.33)	18 (42.86)	7 (16.67)	39 (92.86)
Not breastfed, *n* (%)	1 (2.38)	0	2 (4.76)	3 (7.14)
Vertical transmission of COVID, *n* (%)	0	0	0	

SD: Standard deviation, LGA: Large for gestational age, SGA: Small for gestational age, ICU: ICU: Intensive care unit, NICU: Neonatal ICU, MT: Maturity testing, AGA: Appropriate for gestational age, APGAR: Appearance, pulse, grimace, activity, and respiration

649.10). Maturity testing ranged from 29 to 40 weeks, with a mean of 37.50 weeks. Most were noted to be appropriate for gestational age (n = 35, 83.33%), while five were large for gestational age, and one was small for gestational age. Only five had meconium-stained amniotic fluid (11.90%), four (9.52%) from the asymptomatic mothers and one (2.38%) from the recovered. Thirty-nine neonates (92.86%) were able to have skin-to-skin contact and were immediately breastfed. Neonatal complications were seen in ten (23.81%) babies. All underwent RT-PCR swab on the 24th h of life and there was no documented vertical transmission of COVID-19 with any of the neonates. Among the neonatal outcomes studied, there were statistically significant associations between maternal COVID-19 status with preterm birth ($P = 0.019$) and NICU admission ($P < 0.001$) [Tables 13 and 14].

Discussion

Literature has shown that COVID-19 in pregnant women usually occurred in multiparous maternities with a

Table 13: Association between neonatal outcomes and COVID status using Chi-square tests

Neonatal outcomes	Category	Asymptomatic Group 1		Recovered Group 2		Symptomatic Group 3		*P*
		Count	Column %	Count	Column %	Count	Column %	
NICU admission	No	1	6.7	0	0.0	18	100.0	<0.001
	Yes	14	93.3	9	100.0	0	0.0	
Preterm on maturity testing	No	10	66.7	7	77.8	18	100.0	0.019
	Yes	5	33.3	2	22.2	0	0.0	
LGA	No	14	93.3	8	88.9	15	83.3	0.83
	Yes	1	6.7	1	11.1	3	16.7	
SGA	No	14	93.3	9	100.0	17	94.4	1.000
	Yes	1	6.7	0	0.0	1	5.6	
Meconium staining	No	11	73.3	9	100.0	17	94.4	0.133
	Yes	4	26.7	0	0.0	1	5.6	
APGAR 1<8	No	12	80.0	8	88.9	17	94.4	0.503
	Yes	3	20.0	1	11.1	1	5.6	
APGAR 5<8	No	14	93.3	8	88.9	18	100.0	0.321
	Yes	1	6.7	1	11.1	0	0.0	
Skin to skin	No	1	6.7	2	22.2	0	0.0	0.094
	Yes	14	93.3	7	77.8	18	100.0	
Vertical transmission of COVID	No	15	100.0	9	100.0	18	100.0	
	Yes	0	0.0	0	0.0	0	0.0	
Breastfed	No	1	6.7	2	22.2	0	0.0	0.094
	Yes	14	93.3	7	77.8	18	100.0	

LGA: Large for gestational age, SGA: Small for gestational age, ICU: ICU: Intensive care unit, NICU: Neonatal ICU, APGAR: Appearance, pulse, grimace, activity, and respiration

Table 14: Association of continuous neonatal outcomes and COVID status

Characteristic	Asymptomatic	Symptomatic	Recovered	*P*
Days in NICU*, median (IQR)	3 (2.0-5.0)	4 (3.0-5.0)		0.347
Birthweight**, mean (SD)	2944.7 (683.2)	2721.1 (812.3)	3106.4 (518.0)	0.352

*Data was nonnormal; used Kruskal–Wallis, **Normally distributed; ANOVA was used. IQR: Interquartile range, SD: Standard deviation, ANOVA: Analysis of variance, ICU: ICU: Intensive care unit, NICU: Neonatal ICU

mean and median age of 30 years,[10,11] who were most commonly in their third trimester[8,10,11] with few to no cases in the first trimester.[12] Similarly, this study had a mean age of 31.90 years with mostly multiparous women in their third trimester. Although studies indicated that advanced maternal age was associated with severe illness,[5] this was not reflected in this study as only two from the women with moderate to critical disease were above the age of 35 years.

Similar to the general population, overweight or obese pregnant women[8,9] with chronic hypertension, diabetes mellitus,[5] and pulmonary disease[9] were more prone to severe COVID-19. In contrast, a local study showed that half of pregnant women who acquired SARS-CoV2 infection did not have any comorbidity.[11] This study demonstrated that although hypertensive and diabetic disorders were most common, majority also did not have a comorbid illness. Most of the women were obese by Asian cut-offs,[12] however, it is a limitation that no standard method was used to calculate BMI.

Several studies have shown contrasting results with regard to the clinical presentation. Some presented up to 74% of pregnant as asymptomatic[5,11] while another showed that 69% developed symptoms.[10] The varied and altered immunological response and clinical phenotype were attributed to pregnancy.[13] Interestingly, majority of the research subjects had no symptoms and only a few had histories of exposure to COVID-19, from whom most of these women ended up symptomatic. This highlights the importance of prevention and practice of safety protocols.[6] Symptomatic patients most commonly manifested with cough, fever, and dyspnea, which is analogous to several studies in the pregnant[11,14] and nonpregnant population.[15]

Severity of COVID-19 in pregnancy ranges from mild to critical disease[5] with increased need for hospitalization, mechanical ventilation, and a risk for death as high as 70% compared to the nonpregnant population.[5] However, it is observed in this study that up to 86% of cases remain mild[10] and it was unclear whether hospitalization was secondary to COVID-19 severity or heightened caution associated with pregnancy.[5,16]

The only patient who was diagnosed with critical COVID-19 was a 32-year-old primigravid at 28 4/7 weeks age of gestation. She developed severe pneumonia, followed by ARDS, sepsis, and cytokine storm. Aside

from history of exposure to her husband, she did not have any comorbidities. This strengthens the contrast with the nonpregnant population, where there is more severe disease with preexisting conditions.[6] Initially admitted in the ward, her condition progressed and warranted mechanical ventilation. She underwent primary cesarean section at 29 weeks due to the progressing SARS-CoV2 infection for maximization of treatment. She eventually succumbed to the disease a day after delivery.

As seen in this study, the most common sequelae of COVID-19 were pneumonia. Pulmonary disease remains the most frequent systemic disease in pregnant women with or without COVID-19[5,6] and one of the leading causes of hospital admission in the obstetric population.[5,11] Despite the known prothrombotic state of pregnancy worsened by COVID-19 infection,[5] no patients developed thromboembolic disease.

The current literature observed that mothers with SARS-CoV2 infection delivered by abdominal delivery[11] before term.[5,10] Similarly, majority of the patients in this study indeed delivered by cesarean section for obstetric indications,[3] but most were term births. Notably, two cases that were delivered preterm for iatrogenic cause due to worsening COVID-19. The rationale for deciding to do a cesarean section was likely influenced by anticipation of the possible consequences of COVID-19,[10] however, it must be stressed that the infection in itself is not an indication for cesarean section.[10]

Subsequently, meta-analyses have shown an increase in miscarriages, preterm births, PPROM, preeclampsia, intrauterine growth restriction, and cesarean section rates for maternal condition[14,17] in maternities with SARS-CoV2 infection. Although there were increased adverse obstetric outcomes among women with COVID-19 infection (most commonly preterm labor), these were not found to be statistically associated with COVID-19 infection in the present study. This may be due to the limited sample size. Still, there is a need for further studies and fetal growth monitoring in mothers with COVID-19.[13]

As aforementioned, studies showed increased odds of preterm birth in those with COVID-19,[11] where the spontaneous preterm birth rate was 6%,[5] and 25%–100% of neonates were admitted in the NICU.[5,11] In the present study, the preterm birth rate was 17%. There was statistically significant association between preterm birth and maternal COVID-19 status, which could be due to increased iatrogenic delivery for maternal conditions[5,16,18] as well as reduced access to care for patients due to fear of acquiring the infection.[1]

NICU admission was also found to be associated with COVID-19 status in the present research. This was similar to a local study[11] where all neonates born to mothers with active SARS-CoV2 infection were admitted to the NICU. However, it was unclear whether this was attributed to the neonatal status or institutional protocols. They showed that this had major effects on the practice of essential intrapartum and newborn care as breastfeeding was withheld in 99% of births.[11] Fortunately, majority of the newborns in this study were able to breastfeed for as long as their mothers were stable and wearing a mask. To date, there is remarkably no evidence of vertical transmission, similar to other studies on SARS-CoV2, SARS, and MERS.[19]

Conclusion

The prevalence of COVID-19 in this obstetric population was 3.65%. Most cases occurred in multiparous women at their third trimester with no known comorbidities. Overall, most cases were either asymptomatic or mild with good prognosis despite the theoretical risk that comes with the physiologic changes of pregnancy. Similar to other studies, most were delivered by cesarean section for obstetric indications. COVID-19 status was not found to be associated with adverse maternal outcomes in this study population. However, it is associated with preterm birth ($P = 0.019$) and NICU admission ($P = < 0.001$). Finally, there was no appreciated evidence for vertical transmission.

Limitations

The number of subjects included in the study was limited primarily due to the center being a private institution. This may have contributed as to why statistical tests could not find significant differences in association. Furthermore, not all patients underwent uniform procedures within the institute, which limited information, especially in their antenatal course.

Recommendations

A larger, multicenter study will provide a better understanding on the maternal and neonatal outcomes of COVID-19 in pregnancy in the Filipino population. Subsequent studies may also eventually include patients who underwent quarantine or were managed on an outpatient basis to fully analyze the obstetric population with SARS-CoV2 infection from the antenatal course and beyond the delivery, such as the effects on breastfeeding, puerperium, as well as the mother-baby relationship postpartum.

Acknowledgment

This study would not have been possible without its co-authors. Utmost gratitude is given to the study's statistician for her quality work and contribution.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1. Chmielewska B, Barratt I, Townsend R, Kalafat E, van der Meulen J, Gurol-Urganci I, *et al*. Effects of the COVID-19 pandemic on maternal and perinatal outcomes: A systematic review and meta-analysis. Lancet Glob Health 2021;9:e759-72.
2. COVID Live Update: 203,509,041 Cases and 4,308,547 Deaths from the Coronavirus – Worldometer. Worldometer. Available from: https://www.worldometers.info/coronavirus/?utm_campaign=homeAdvegas1?. [Last accessed on 2021 Aug 09].
3. Schwartz DA, Graham AL. Potential maternal and infant outcomes from (Wuhan) coronavirus 2019-nCoV infecting pregnant women: Lessons from SARS, MERS, and other human coronavirus infections. Viruses 2020;12:194.
4. Zhao X, Jiang Y, Zhao Y, Xi H, Liu C, Qu F, *et al.* Analysis of the susceptibility to COVID-19 in pregnancy and recommendations on potential drug screening. Eur J Clin Microbiol Infect Dis 2020;39:1209-20.
5. Elsaddig M, Khalil A. Effects of the COVID pandemic on pregnancy outcomes. Best Pract Res Clin Obstet Gynaecol 2021;73:125-36.
6. Ko JY, DeSisto CL, Simeone RM, Ellington S, Galang RR, Oduyebo T, *et al*. Adverse pregnancy outcomes, maternal complications, and severe illness among US delivery hospitalizations with and without a coronavirus disease 2019 (COVID-19) diagnosis. Clin Infect Dis 2021;73:S24-31.
7. Qiancheng X, Jian S, Lingling P, Lei H, Xiaogan J, Weihua L, *et al*. Coronavirus disease 2019 in pregnancy. Int J Infect Dis 2020;95:376-83.
8. Breslin N, Baptiste C, Gyamfi-Bannerman C, Miller R, Martinez R, Bernstein K, *et al*. Coronavirus disease 2019 infection among asymptomatic and symptomatic pregnant women: Two weeks of confirmed presentations to an affiliated pair of New York City hospitals. Am J Obstet Gynecol MFM 2020;2:100118.
9. Knight M, Bunch K, Vousden N, Morris E, Simpson N, Gale C, *et al*. Characteristics and outcomes of pregnant women admitted to hospital with confirmed SARS-CoV-2 infection in UK: National population based cohort study. BMJ 2020;369:m2107.
10. Della Gatta AN, Rizzo R, Pilu G, Simonazzi G. Coronavirus disease 2019 during pregnancy: A systematic review of reported cases. Am J Obstet Gynecol 2020;223:36-41.
11. Clemente MJ, Amosco M, Octavio MB, Bravo SL, Villanueva-Uy E. Maternal and neonatal outcomes of pregnant women with clinically confirmed COVID-19 admitted at the Philippine General Hospital. Acta Med Philipp 2021;55:185-190. [doi: 10.47895/amp.v55i2.2863].
12. Lim JU. Obesity Classification According to WHO and Asia Pacific Guideliens. Available from: https://www.dovepress.com/cr_data/article_fulltext/s141000/141295/img/COPD-141295-T01.png. [Last accessed on 2017 Jul 13].
13. Smith V, Seo D, Warty R, Payne O, Salih M, Chin KL, *et al.* Maternal and neonatal outcomes associated with COVID-19 infection: A systematic review. PLoS One 2020;15:e0234187.
14. Blitz MJ, Rochelson B, Rausch AC, Solmonovich R, Shan W, Combs A, *et al*. Universal testing for coronavirus disease 2019 in pregnant women admitted for delivery: Prevalence of peripartum infection and rate of asymptomatic carriers at four New York hospitals within an integrated healthcare system. Am J Obstet Gynecol MFM 2020;2:100169.
15. Philippine Society for Microbiology and Infectious Diseases, Philippine College of Chest Physicians, Philippine College of Physicians, Association Philippine College of Hematology and Transfusion Medicine, & Philippine Rheumatology Association. Interim Guidelines on the Clinical Management of Adult Patients With Suspected or Confirmed COVID-19 Infection (3,1 ed.); 2020.
16. Center for Disease Control and Prevention. COVID-19 and Your Health. Centers for Disease Control and Prevention. Available from: https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/index.html. [Last accessed on 2020 Feb 11].
17. Di Mascio D, Khalil A, Saccone G, Rizzo G, Buca D, Liberati M, *et al*. Outcome of coronavirus spectrum infections (SARS, MERS, COVID-19) during pregnancy: A systematic review and meta-analysis. Am J Obstet Gynecol MFM 2020;2:100107.
18. Martinez-Perez O, Prats Rodriguez P, Muner Hernandez M, Encinas Pardilla MB, Perez Perez N, Vila Hernandez MR, *et al*. The association between SARS-CoV-2 infection and preterm delivery: A prospective study with a multivariable analysis. BMC Pregnancy Childbirth 2021;21:273.
19. Yang Z, Wang M, Zhu Z, Liu Y. Coronavirus disease 2019 (COVID-19) and pregnancy: A systematic review. J Matern Fetal Neonatal Med 2022;35:1619-22.
20. Abbassi-Ghanavati M, Greer LG, Cunningham FG. Pregnancy and laboratory studies: A reference table for clinicians. Obstet Gynecol 2009;114:1326-31.