



Original Article

# Experience of “Purple code” to Manage COVID-19 Pregnant Women

## *Expérience du “Code violet” dans la prise en charge de la COVID-19 chez les femmes enceintes*

Laura Marcela Cano Murillo<sup>1</sup>, Lenny Piña Guerrero<sup>2</sup>, Betsy Corina Sosa García<sup>3</sup>, Miriam Deyanira Rodríguez Piña<sup>4</sup>, Verónica Gil Venadero<sup>5</sup>, Hugo Mendieta Zerón<sup>6</sup>, Carlos Arturo Paniagua Coahuila<sup>7</sup>

### ABSTRACT

**Objective.** The world is facing a SARS-CoV-2 coronavirus pandemic. One of the greatest challenges of the current pandemic is its high speed of transmission, such that its global spread has caused more deaths than its predecessors along with the collapse of health services. **Patients and methods.** This retrospective, cross-sectional study performed on the second half of 2020 was designed to describe the experience in managing COVID-19 pregnant women through a logistic called “Purple code”. **Results.** During the study period, 70 women (mean age 24.33 years old) were subjected to be managed under the “purple code”. Gestational age <35 WG prevailed in the study. The analysis showed that the most frequent procedures performed in the toco-surgery service were cesarean section (91%), followed by natural childbirth (7%), instrumented uterine curettage (1%), and tracheostomy (1%). Among the health staff involved in the direct treatment of the patients there were no fatal cases or hospitalizations. **Discussion.** The protocol established in the HMPMPS is in accordance with the recommendations of international guidelines for maternal and perinatal care, preventing at the same time the risk of infection in the health staff. **Conclusion.** A positive impact has been achieved in the case management of patients with COVID-19 where strict and rigorous measures were established, classified as “purple code”.

### RÉSUMÉ

**Objectif.** Le monde est confronté à la pandémie de coronavirus SARS-CoV-2. L'un des plus grands défis de la pandémie actuelle est sa vitesse de transmission élevée, de sorte que sa propagation mondiale a causé plus de décès que ses prédécesseurs ainsi que l'effondrement des services de santé. **Patients et méthodes.** Cette étude rétrospective et transversale réalisée sur le second semestre 2020 a été conçue pour décrire l'expérience de prise en charge des femmes enceintes COVID-19 à travers une logistique appelée "Code Violet". **Résultats.** Au cours de la période d'étude, 70 femmes (âge moyen 24,33 ans) ont été soumises à une prise en charge sous le « Code Violet ». L'âge gestationnel <35 SA a prédominé dans l'étude. L'analyse a montré que les actes les plus fréquemment pratiqués dans le service de toco-chirurgie étaient la césarienne (91%), suivie de l'accouchement naturel (7%), du curetage utérin instrumenté (1%) et de la trachéotomie (1%). Parmi le personnel de santé impliqué dans le traitement direct des patients, il n'y a eu aucun cas mortel ou d'hospitalisation. **Discussion.** Le protocole établi dans le HMPMPS est conforme aux recommandations des lignes directrices internationales pour les soins maternels et périnataux, prévenant en même temps le risque d'infection chez le personnel de santé. **Conclusion.** Un impact positif a été obtenu dans la prise en charge des patients atteints de COVID-19 où des mesures strictes et rigoureuses qualifiées de « Code Violet » ont été établies.

<sup>(1)</sup> Institución Universitaria Colegio Mayor de Antioquia, Medellín, Colombia.

<sup>(2)</sup> Hospital Materno-Perinatal “Mónica Pretelini Sáenz”, Toluca, Mexico.

<sup>(3)</sup> Faculty of Nursery, Autonomous University of the State of Mexico, Toluca, Mexico.

<sup>(4)</sup> Faculty of Medicine, Autonomous University of the State of Mexico, Toluca, Mexico.

<sup>(5)</sup> Faculty of Medicine, Autonomous University of the State of Mexico, Toluca, Mexico.

<sup>(6)</sup> Faculty of Medicine, Autonomous University of the State of Mexico and Hospital Materno-Perinatal “Mónica Pretelini Sáenz”, Toluca, Mexico.

<sup>(7)</sup> Hospital Materno-Perinatal “Mónica Pretelini Sáenz”, Toluca, Mexico.

#### Corresponding author

Hugo Mendieta Zerón, MD. PhD.  
Faculty of Medicine, Autonomous University of the State of Mexico (UAEMéx), Toluca, Mexico. Av Paseo Tollocan, Moderna de la Cruz, 50180 Toluca, Mexico.  
Telephone: +52 722 217 4831.  
Email: drmendietaz@yahoo.com

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### INTRODUCTION

Humanity is facing the third pandemic outbreak of severe respiratory disease caused by the SARS-CoV-2 coronavirus; the first outbreak was caused by the MERS-CoV in 2002. While the lethality of SARS-CoV-2 is moderate compared to that of MERS (35%) and SARS (9.6%), one of the greatest challenges of the current pandemic is the high speed of its spread, such that its global spread has caused more deaths than its predecessors, along with the collapse of health services [1].

In Mexico, the maternal morbidity and mortality rate have been estimated at 34.5 deaths per 100,000 births. This increase is related to indirect factors in the use and

availability of health services [2]. The National Center for Gender Equity and Reproductive Health projects that in the period from April to June 2020, there will be about 260,000 obstetric events, i.e. more than 235,000 births, 25,000 abortions, more than 1,150,000 prenatal consultations, and almost 200,000 consultations during the postpartum period [3].

The clinical care of pregnant women with a positive diagnosis of COVID-19 is based on the severity of the disease. It is known that 85% of these patients present mild symptoms and, in the absence of obstetric problems, do not require an in-hospital stay; in fact, it is recommended that



they receive outpatient medical treatment [4]. However, it seems that the risk of fetal distress, preterm birth and premature rupture of membranes (PROM) increases with the onset of COVID-19 in the third trimester of pregnancy. Although there is not yet sufficient evidence of intrauterine and transplacental SARS-CoV-2 transmission to the fetus in the third trimester of pregnancy [5], pregnant women who are admitted to the health service are being followed up more carefully.

There is evidence that vaginal birth is not associated with a high risk of neonatal infection [6]. A Chinese study of nine infants showed that there was no transmission of COVID-19 from mother to fetus during the third trimester; the virus was not found in breast milk, throat, umbilical cord blood or amniotic fluid of neonates born via cesarean section. In contrast, in a case report in Great Britain of a neonate with COVID-19 born vaginally, it was noted that the patient tested positive at 36 hours of life and it is unclear whether the transmission was prenatal, postnatal, or whether an infection was acquired during birth [7].

One of the concerns in hospitals has been how to reduce the transmission of the virus from patients to health personnel, for which the most notable efforts have been in protective equipment, and less has been said about logistical strategies for institutional reorganization to move patients safely for everyone. This research aims to observe the behavior of COVID-19 in pregnant women attending the toco-surgery service in a third level hospital through the implementation of the “Purple code.”

**MATERIALS AND METHODS**

A descriptive, retrospective study was conducted. The “Mónica Pretelini Saéz” Maternal Perinatal Hospital (HMPMPS), Health Institute of the State of Mexico, in Toluca, Mexico, implemented the “Purple code”, to standardize and create algorithms to guide all hospital staff on how to act during the care of a suspected or confirmed case of COVID-19 with the target of preventing its easy spread.

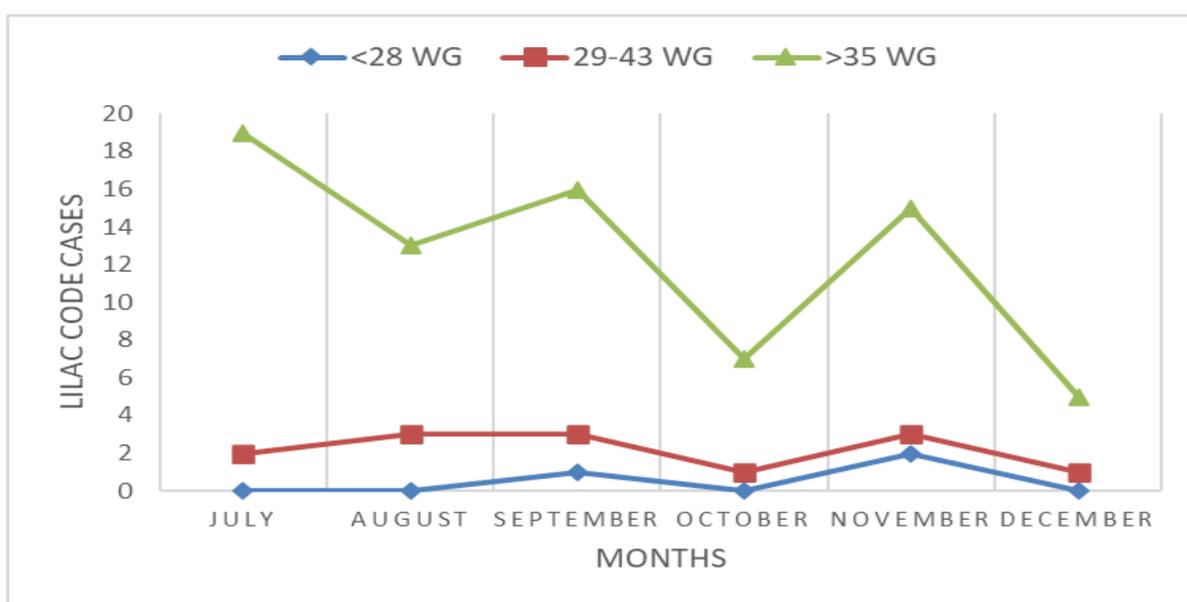
The “purple code”, when a patient with suspected or confirmed COVID-19 arrived at the hospital, consisted of the following: a) a specific office was determined for her care, b) specific routes (including the allocation of an exclusive elevator), were limited for the patients’ mobilization within the hospital, c) when an intra-hospital displacement was made, no other person was allowed to pass through the established route, d) patients were moved on a stretcher with a capsule to avoid spreading the SARS-CoV-2 virus through fomites, e) when a patient had to be mobilized, it was notified through the hospital’s voice system to clear the routes indicated for it.

The information used for the analysis of this study was provided by the toco-surgery area of the HMPMPS, a third level institution and referral center for patients with complicated pregnancies who arrived at the service during the months of July and August of the year 2020.

Data collection was carried out using the Excel program, considering variables such as age, type of procedures performed, weeks of gestation (WG), gestation number, and degree of obstetric hemorrhage on admission to the service of women who were classified as “purple code”. Subsequently, a descriptive analysis was performed, obtaining graphs for review. This study was approved by the Research Ethics Committee and the HMPMPS Research Committee.

**RESULTS**

During the study period, 70 women (mean age, 24.33 years old) were subjected to be managed under the “purple code”. Gestational age <35 WG prevailed in the study (Figure 1). The analysis showed that the most frequent procedures performed in the toco-surgery service were cesarean sections (91%), followed by natural childbirth (7%), instrumented uterine curettage (1%), and tracheostomy (1%).



**Figure 1.** Classification of “purple code” patients month by month, according to week of gestation

When analyzing patients with hypertensive disease at the time of admission to the service, patients with preeclampsia were the most common (41%), followed by chronic hypertension (24%), severe preeclampsia (17%), and hypertension (10%).

According to the number of gestations, 21% were primigravida, 35% secundigravida and 44% were in their third gestation. Finally, regarding obstetric hemorrhage, it was found that 76% of patients had grade I (500-750 ml), 15% grade II, 9% grade III, and there were no cases of grade IV.

About the most important intention of the study, which was to reduce the transmissibility of the infection, seems achieved with the absence of fatal cases or hospitalizations among the health personnel who treated the patients treated in the “purple code”.

## DISCUSSION

Antenatal care, as a health service during the current COVID-19 pandemic, along with sexual and reproductive health care, are considered essential for the mitigation and prevention of SARS-CoV-2 transmission in newborns, in relation to epidemiological data indicating an increased risk for women of childbearing age and during gestation. Thus, there is a need to pursue strategies to create algorithms to standardize and guide hospital staff during perinatal care [8].

The strategies proposed for SARS-CoV-2 infection during pregnancy are created with the objective of intensifying and maintaining efforts to guarantee and increase the care of the woman and her product. The protocol established in the HMPMPS is in accordance with the recommendations of the Dominican Society of Obstetrics and Gynecology Guidelines (DSOG): 1. Establish a diagnosis; 2. In the case of finding a positive/confirmed patient, she will be transferred to an isolation room; 3. Perform the corresponding studies to determine the severity of the disease, and provide timely and effective treatment in order to safeguard the life of the product as well as that of the mother [9].

Similarly, the protocol established at the Hospital of Barcelona, Spain, indicates that it is important to consider that COVID-19 infection can be asymptomatic in 75% of pregnant women, and of these cases 85% present a mild infection. According to these data, the institution performs a serological screening that consists of: a) pre-admission and the subsequent performance of a COVID-19 PCR test as close as possible to the date of admission, whether for childbirth or surgery, in order to avoid any contagion; b) in women with a history of COVID-19, and of the accompanying person; c) repeat screening in pregnant women who are admitted, in order to reach an early diagnosis, clinical management, and effective treatment [10].

The guidelines presented here are emphatically and initially intended to guide the prevention of maternal and neonatal morbidity due to COVID-19. For this reason, it is necessary to adapt and maintain strategies for planning, implementation, and coordination of useful measures to cover the demand for maternal-perinatal health care, given that the management of obstetric emergencies and

complications requires a balance between resources and time to ensure care.

At the same time, the data obtained in this study of the HMPMPS regarding the incidence of the number of cesarean sections are higher than those reported by Bellos et al., where cesarean section rates are up to 83.5%, data that warn about perinatal transmission and the severity of maternal infection. While in the same study, the estimated risk of preeclampsia was low, the opposite of our results was found [11].

In other research, it is mentioned that cesarean section as the route of birth ranges in 50.8%, being the main indication in pregnant patients with COVID-19, but lower than the percentage found in our study [12].

Pregnant women infected with SARS-CoV-2 show an increased incidence of preterm birth. It is well known that the presence of cervical shortening and the threat of preterm birth in the absence of other etiological factors should arouse the clinician's suspicion of COVID-19 infection [13].

It is important to consider the pre-surgical preparation of a confirmed or suspected patient with COVID-19. The surgical procedure is considered close contact, as are intubation, regional anesthesia, and line cannulation. For this reason, personal protective equipment must be worn by the surgeon, assistant, anesthesiologist, surgical nurses, and circulators [14].

The care provided in postoperative surveillance following surgical procedures should not be underestimated and should be carried out in isolation units with adequate monitoring, that establishes exclusive isolation for this cohort of patients [15].

There is currently insufficient evidence about the relationship between COVID-19 and the need for cesarean section. However, in a study of 399 women, the odds of preterm delivery (3.01; 95% CI 1.16 to 7.85; I<sup>2</sup> = 1%) were found to be higher in pregnant women with COVID-19 compared to those without COVID-19 [16].

Different studies describe that pregnant women with SARS-CoV-2 infection are generally symptomatic during the third trimester of pregnancy, and suggest that there may be a direct relationship between age and the risk of contracting the disease, as it is one of the factors associated with a worse prognosis, as are BMI and other comorbidities developed during pregnancy [17].

There are reports of a syndrome similar to preeclampsia in pregnant patients with COVID-19 given that both share pathophysiological, clinical, and laboratory data that represent a diagnostic challenge [18]. A higher rate of preeclampsia is also known in patients with SARS-CoV-2 than in healthy patients [19]. This association is independent of pre-existing conditions, risk factors and the severity of COVID-19 [20].

Women with preeclampsia are considered a vulnerable group regarding the risks posed by SARS-Cov-2 infection. Therefore, it is important to identify them and to have closer surveillance by the multidisciplinary team for their care, in order to avoid delays in diagnosis and to prevent the spread of infection among health personnel [19], through laboratory tests such as PCR, to all women with high-risk pregnancies and with symptoms suggestive of pre-

eclampsia. If the diagnosis is positive, isolate the patient, perform an MRI scan, and admit her to intensive care [21]. The “purple code” experience at HMPMPS shares the strategy to reduce exposure and mortality rates.

Most of the cases occurred in July, due to the fact that the COVID-19 disease was very recent and there were doubts and uncertainty regarding the behavior of the virus. However, with the passage of time, more progress has been made in terms of the research carried out, achieving greater control over the management of SARS Cov-2 infection, especially within health institutions, which can be a focus of infection as they are very crowded places.

## CONCLUSION

A positive impact has been observed in the management of COVID-19 cases in the toco-surgery area of the HMPMPS, as this is an essential area of medical care and, in accordance with the work of the institution, it must have strict and rigorous measures for the management of patients classified as “purple code”. It is important to continue creating strategies to preserve and improve the health of patients and medical staff, and as far as it can be inferred from the experience of this survey, the “purple code” strategy has prevented the SARS-CoV-2 spread within the institution.

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## Author Contributions

- (I) Conception and design: CAPC, LPG, HMZ.
- (II) Administrative support: CAPC, LPG, HMZ.
- (III) Provision of study materials or patients: CAPC.
- (IV) Collection and assembly of data: All authors.
- (V) Data analysis and interpretation: MDRP, BCSG, VGV, HMZ.
- (VI) Manuscript writing: All authors
- (VII) Final approval of manuscript: All authors

## Conflicts of interest

The authors have no conflicts of interest to declare.

## Ethical Statement

The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and approved by the Ethics in Research Committee (code: 2021-05-734) of the HMPMPS. Informed consent was not required as this was a descriptive and retrospective study.

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