COVID-19, obstetrical management of a successful case *

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Abstract

The COVID-19 infection, in its broad manifestation of symptoms and hemodynamic clinical behavior in the pregnant patient, has shown that its spectrum can vary from severe level. In the present work, we report the successful management and approach of a 24-SS patient with type I respiratory failure associated with severe primary Acute Respiratory Distress Syndrome (ARDS) with inflammatory-type H phenotype with severe hypoxemia and alveolar occupation quadrants with septic shock and severe pneumonia due to SARS-CoV-2 with positive PCR for COVID-19.

Covid-19, manejo obstétrico de un caso exitoso

Resumen

La infección COVID-19 en su amplia manifestación de síntomas y comportamiento clínico hemodinámico en la paciente embarazada, ha demostrado que puede variar su espectro desde leve a severo. En el presente trabajo se reporta el manejo y abordaje exitoso de paciente de 24 SS de gestación con insuficiencia respiratoria tipo I asociada al Síndrome de dificultad respiratoria aguda (SDRA) primario severo con fenotipo H de tipo inflamatorio con hipoxemia severa y ocupación alveolar de los cuatro cuadrantes con choque séptico y neumonía severa por SARS-CoV-2 con PCR positiva para COVID-19.

COVID-19, gestão obstétrica de um caso de sucesso

Resumo

Palavras-chave
Gravidez Abdominal; Feto; Síndrome Respiratória Aguda Grave; Infecções Coronavírus; Resultados dos cuidados críticos.

A infecção pela COVID-19 em sua ampla manifestação de sintomas e comportamento clínico hemodinâmico na paciente grávida mostrou variar em espectro de leve a grave. No presente trabalho relatamos a gestão e abordagem bem sucedida de um paciente de 24 semanas de gestação com insuficiência respiratória tipo I associada à síndrome de desconforto respiratório agudo primário grave (SARS-CoV-2) com fenótipo H de tipo inflamatório com hipoxemia grave e ocupação alveolar dos quatro quadrantes com choque séptico e pneumonia grave devido à SARS-CoV-2 com PCR positiva para COVID-19.

1. Introduction

The disease COVID-19, coronavirus or SARS CoV-2, affects indiscriminately the human population, with involvement of women close to 50% of the total diagnosed. Guan and collaborators found that the mean age of patients affected by the disease was 47 years and 41.9% corresponded to women (Borre-Naranjo, Santacruz, Gonzalez-Hernandez, Anichiarico, Rubio-Romero, 2020; Guan *et al.,* 2020). For Colombia, the percentage of affected women corresponds to 52.49%, with a higher commitment for age ranges between 20- 39 years (Panorama General - Infogram, n.d.), a worrying situation because according to the report of the Instituto Nacional de Salud (2021), by October 2021, 17. 812 pregnant women have been infected with the infection, of which 8187 correspond to the third trimester (Instituto Nacional de Salud, Ministerio de Salud y Protección Social, 2021); although to date, research does not indicate that pregnant women are more likely to be infected than the rest of the population; according to previous studies, pregnant women are a population vulnerable to infectious processes since the changes inherent to pregnancy imply that the immune system modifies its response towards the T-helper-2 (Th2) system domain, which protects the fetus, but leaves the mother vulnerable to viral infections (Prabhudas *et al.,* 2015); and, indeed, COVID-19 infection in the pregnant patient has been shown to vary in the spectrum from mild to severe, with development of Acute Respiratory Distress Syndrome (ARDS) (Borre-Naranjo et al., 2020; Wong et al., 2004). To date, reports show that, although most mothers are discharged without major complications, there is a fraction (approximately 3.5%) that may present severe maternal morbidity and perinatal deaths as a result of COVID-19, without being able to rule out the vertical transmission of the disease. For Colombia, the number of deaths as of October 2021 is 217 (Instituto Nacional de Salud, Ministerio de Salud y Protección Social, 2021).

Proper management of this disease requires a thorough knowledge of the normal adaptive hemodynamic changes that occur during gestation; among them, changes in total vascular resistance, increased systolic volume, increased heart rate, increased blood volume, physiological increase in ventilation per minute, reduced residual capacity, upward displacement of the diaphragm, increased distensibility of the chest wall, all of them with a requirement for increased oxygen consumption (Carrillo-Mora *et al.,* 2021). In the obstetric population, rapid cardiopulmonary decompensation can occur due to decreased cardiac and pulmonary reserves. This becomes a challenge for the Intensive Care Unit (ICU) team, who are faced with a patient with hemodynamics that is different from those of a non-pregnant adult. Additionally, maternal hypoxemia and changes in uteroplacental blood flow can cause fetal hypoxia and lead to irreversible damage to the child (Bandi, Munnur, Matthay, 2004). Therefore, this article aims to report the management and approach of a pregnant patient with SARS-CoV-2 and acute ARDS with a successful maternal-perinatal outcome.

2. Case study

A 36-year-old female patient, G3A1P1V1 with a singleton pregnancy of 24.4 weeks, consulted a tertiary care institution in the city of Cali, presenting odynophagia, cough with expectoration, and fever (38.5°C). On evaluation, she was found with a choking sensation, a reduction of her functional class, and subsequent hemodynamic deterioration with polypnea, tachycardia, basal rales in pulmonary auscultation, and O_2 saturation 88-89%. Paraclinical examinations showed severe oxygenation impairment (PAFIO$_2$: 123 and PAO$_2$: 54 mmHg). He partially improved with cannulated O_2. Chest CT showed a rapidly progressive stage with the accumulation of a large amount of cell-rich exudates in the alveolar cavity, vascular expansion, and exudation in the interstitium, with consolidation showing fused alveolar lumen and large-scale air bronchogram inside (Figure 1).
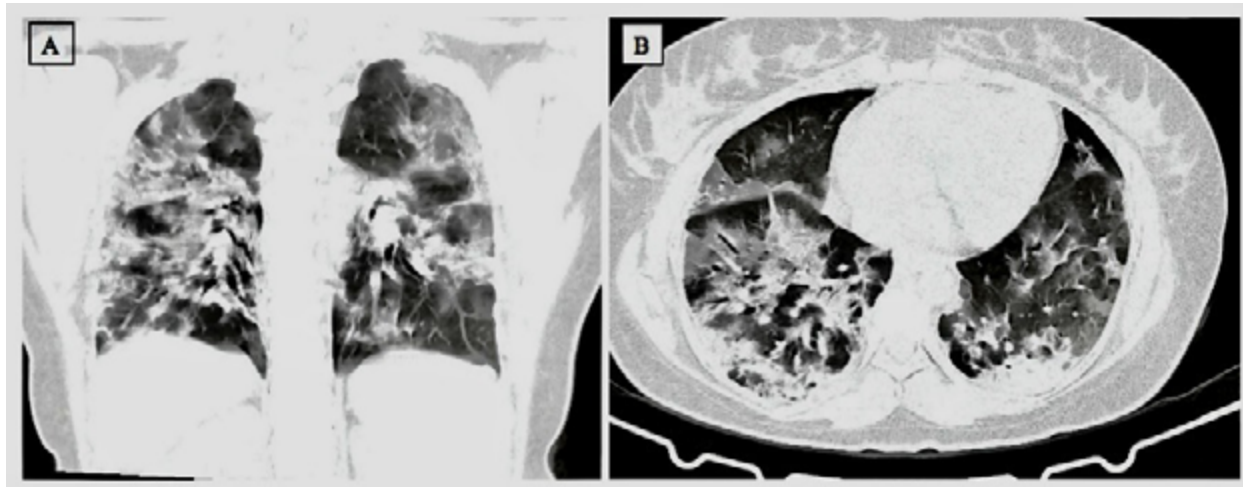
Figure 1. Chest computed tomography. A) Coronal view. B) Axial view. There is an accumulation of exudates in the alveolar cavity, vascular expansion, and exudation in the interstitium, consolidation demonstrating a large-scale fused alveolar lumen with air bronchogram inside.
Source: Authors

Moderate to severe ARDS associated with hyperlactatemia (lactate 2.6 mmol/ml), metabolic acidosis (BE -8), and polypnea (FR 32 RPM) was diagnosed in a patient with high clinical and paraclinical suspicion of SARS-CoV-2. Immediate transfer to ICU and initiation of hydroxychloroquine (400 mg/12h orally for 24 hours and then 200 mg/12h for 7 days) and azithromycin (500 mg/24h for 7 days). The airway was secured under anesthesia and advanced management with invasive mechanical ventilation in the context of gestation was defined according to national protocol guidelines for intensive mechanical care for PEEP titration every 12 hours with neuromuscular relaxation and PEEP titration for alveolar recruitment according to ventilatory mechanics (Figure 2).

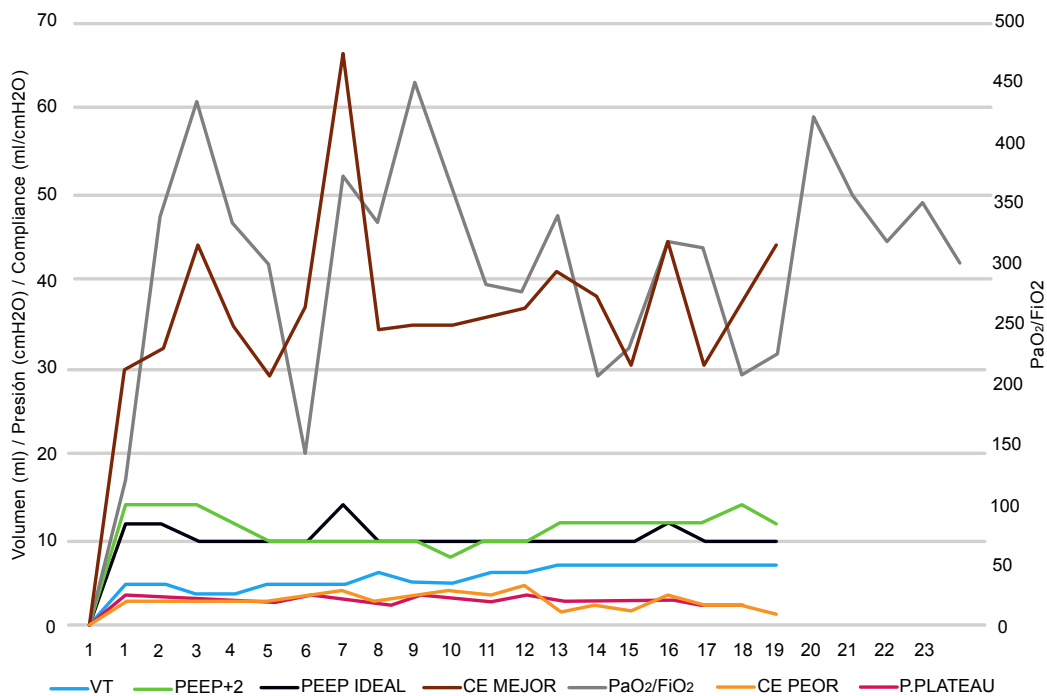**Figure 2.** Ventilatory parameters of the patient during her stay in the ICU.
Source: Authors

During monitoring, metabolic acidemia due to hyperchloremia was found; she required bicarbonate fluid replacement with a dose of 70 cc/h until hydro electrolytic control (Table 1). During the maternal hemodynamic assessment, elevated arterial pressures of 169/80 mmHg were evidenced. The 24-hour proteinuria showed 360 mg of protein/dL, so a diagnosis of non-severe preeclampsia was added. Antihypertensive treatment was started with nifedipine 30 mg/12h.

Table 1.
Maternal clinical laboratory results. (g/dL) grams/deciliter, (cell/mm3) cells per cubic meter, (sec) seconds, (U/L) units per liter, (mmol/L) millimoles per liter, (mmHg) millimeters of mercury, (mg/dL) milligrams per deciliter.

Measurement	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15
Hemoglobin (g/dL)	11.7	11.6	10.2	6.9	7.0	5.1	8.3	9.7	10.1	10.4	9.6	10.8	11.1	11.6	10.1
Leukocytes (cells/mm³)	16330	11980	13100	11420	23030	19950	19410	15020	13050	13720	11280	16330	1470	17160	12100
Neutrophils (cells/mm³)	14610	10410	11050	10510	17940	15270	16470	13350	12230	12140	9643	14370	12120	14910	9600
Platelets (cell/mm³)	233	205	211	181	269	202	173	114	123	142	152	186	254	291	319
PT/TPT (sec)	N/A	N/A	N/A	N/A	15/23	N/A	N/A	N/A	12/30	12/35	N/A	N/A	N/A	28/20	N/A
Fibrinogen (mg/dL)	N/A	N/A	N/A	N/A	N/A	1.34	N/A	N/A	N/A	1.05	N/A	N/A	N/A	N/A	N/A
Sodium (mmol/L)	136	133	137	136	N/A	137	138	137	134	N/A	135	133	138	137	136
Potassium (mmol/L)	4.7	4.1	3.6	4.2	4.4	3.7	3.7	N/A	3.7	3.9	2.4	3.7	4.6	3.9	3.7
Chlorine (mmol/L)	107	107	113	116	N/A	112	105	N/A	106	N/A	107	112	107	110	110
Magnesium (mmol/L)	N/A	N/A	1.8	N/A	N/A	N/A	N/A	2	2.1	N/A	N/A	N/A	N/A	N/A	N/A
Phosphorus (mmol/L)	N/A	N/A	3.1	N/A	N/A	N/A	N/A	2.2	2.2	N/A	N/A	N/A	N/A	N/A	N/A
Creatinine (mg/dL)	0.5	0.4	0.5	0.6	0.6	0.6	0.5	0.5	N/A	0.4	0.4	0.5	0.3	0.2	0.3
BUN (mg/dL)	10	11	15	18	23	19	20	18	12	8	6	15	13	10	9
LDH (U/L)	248	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AST/ALT (U/L)	28/49	N/A	N/A	N/A	N/A	N/A	N/A	27/19	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lactic Ac. Lactic (mmol/L)	0.9	1.1	1.1	N/A	1.6	1.2	1.5	0.8	N/A	1.2	1	2.6	2.0	1.1	0.9
PH	7.39	7.40	7.41	7.46	7.47	7.39	7.41	7.40	7.47	7.45	7.47	7.39	7.44	7.42	7.43
PO2 (mmHg)	88.3	79.4	148.8	121.4	124.8	99	117.7	95.7	104.9	105.6	88	120.3	107.3	108.3	130.3
PCO2 (mmHg)	34.8	31	34	24.5	24.2	21.2	29.1	30.5	35	34.7	36.7	30.7	39.6	34.9	31.4
HCO3 (mmol/L)	20.7	20.6	21.3	17.3	16.3	15.1	17.4	19	4.2	25	23.3	21.9	23.4	23.3	19.9
BE (mmol/L)	-3.4	-4.7	-2.6	-3.3	-6.7	-6.1	-6.7	-4.3	-2.9	1.8	1.6	-0.7	-1.2	-0.2	-3.8
PAFI	252	226	425	N/A	416	N/A	N/A	316	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RT-PCR COVID				+											
Urine protein24 H (mg/dL)										435					

Source: Authors

Continuous fetal monitoring was performed with a basal FHR of 135 bpm, under sedoanalgesia and relaxation, as was the mother. Fetal ultrasound showed no associated malformations, fetal vitality, and growth in appropriate percentiles for gestational age. Doses of fetal maturation inducers with betamethasone were given in full schedule (12 mg IM/day for 2 doses).

During maternal-fetal management in the obstetric ICU, antibiotic coverage was provided with vancomycin (1g iv/12h) + piperacillin tazobactam (4.5 g iv/6h), due to suspicion of superinfection. Due to the severity of the clinical picture, 10 hours later, full anticoagulation was started (enoxaparin 60 mg sc/12h), and given the positive test, management with institutional COVID-19 protocol: azithromycin, hydroxychloroquine, steroid (methylprednisolone 60 mg iv/day) and it was decided to add ivermectin (1.7 CC orally/day for 5 days).

At 27 weeks gestation, with fetal weight >800 grams, the patient required PEEP titration due to impaired compliance and significant limitation of diaphragmatic outflow. In a joint decision with the intensivist, pediatrician, neonatologist, and family members, it was decided to terminate the pregnancy by discharge. Transperitoneal Kerr cesarean section was performed, resulting in a live newborn, male sex, weight 850 grams, head circumference 24 cm, height 34 cm, and apgar 1/10 at one minute, 4/10 at 5 min, and 7/10 at 10 min. COVID-19 negative.

Complete placenta extraction, and adequate uterine involution. Delivery was performed with carbetocin 100 U without complications. In the mediate puerperium, the patient presented improvement in ventilatory parameters with increased thoracic expansion and higher inspiratory volumes due to decreased intra-abdominal pressure. PAFIO$_2$ of 403 mmHg, under sedoanalgesia and muscle relaxation. After 24 days of hospitalization, it was decided to suspend muscle relaxation and start the sedoanalgesia weaning process. At 25 days she was extubated without complications and RT-PCR control for COVID-19 was negative. The patient presented clear improvement of hemodynamic profiles, without requiring supplemental O2. With the final diagnosis of type I respiratory failure associated with severe primary ARDS with inflammatory phenotype H with severe hypoxemia and alveolar occupation of the four quadrants with septic shock, severe SARS-CoV-2 pneumonia, non-severe preeclampsia with positive PCR for COVID-19, the patient was discharged, completely asymptomatic at 40 days of hospitalization.

3. Discussion

The new type of coronavirus (SARS-CoV-2) causing the infectious disease COVID-19 (coronavirus disease), is responsible for acute respiratory syndrome and due to its high ease of transmission since its detection in December 2019, to date has infected 219,456,675 people worldwide. At the beginning of the pandemic, attention was focused on the older adult population, given that the risk of becoming ill with COVID-19 and having severe outcomes increases with age; according to reports, mortality of 8% is found in patients aged 70 years and in patients older than 80 years mortality rises to 14.8% (Wang L, Wang Y, Ye, Liu, 2020); However, the population of pregnant women corresponds to a group vulnerable to infection due to the modifications of their immune system that make them susceptible to infections, mainly of the viral type (Prabhudas *et al.,* 2015).

The physiological adaptations inherent to pregnancy, become a major challenge in the hemodynamic management of a woman who presents different behaviors during the trimesters of gestation, labor, delivery per se, and postpartum, where maximization of maternal cardiac output must be guaranteed with an adequate discharge of inflammatory and hormonal mediators within the endothelium that allows a balance of fluid displacement between the interstitial, intra-extracellular compartments (Kimberlin, Stagno, 2020).

It is important to highlight that maternal sepsis associated with ARDS can exacerbate alterations in the inflammatory cascade and lead to further endothelial dysfunction, pulmonary edema, myocardial edema, and heart failure (Schnettler, Al Ahwel, Suhag, 2020), being contraindicated the decision to initiate labor (Kimberlin, Stagno, 2020). For this reason, cardiopulmonary stability should be achieved first as long as maternal and fetal conditions allow, to obtain a live newborn. In this case, evacuation of the uterus was performed to facilitate improvement in cardiopulmonary function and maternal ventilatory parameters.

The evidence of treatment in severe ARDS in maternal COVID-19 demonstrates that the use of 1) corticosteroids in short courses at low doses, has lower adverse effects and better maternal prognosis (Yi, Lagniton, Ye, Li, Xu, 2020), 2)

fetal neuroprotection with magnesium sulfate as a standard and usual indication in pregnancies under 32 weeks and with a high risk of imminent delivery, produces an additional benefit in bronchodilation of the maternal on invasive mechanical ventilation (oro tracheal intubation: OTI) (Wu, McGoogan, 2020), 3) the use of antiviral agents such as hydroxychloroquine and lopinavir/ritonavir may be effective against the virus in ARDS (Bernal, Lopez Zea, Salazar-Rey, Gomez-Laiton, Camacho-Lopez, 2020; White *et al.,* 2020). However, antivirals containing neuramidamide inhibitors such as oseltamivir have not shown benefits in the management of patients with COVID-19 (Arabi, Fowler, Hayden, 2020).

Regarding the management of water and electrolyte resuscitation, it is important to avoid water overload, reach a negative balance and prevent pulmonary edema and cardiac collapse, so it is recommended that intravenous fluids should not exceed 125 ml/h (Bandi *et al.,* 2004).

In mothers with COVID-19, noninvasive modes of ventilation, such as continuous or positive airway pressure, are not recommended due to an increased likelihood of failure, with the imminent need for change to an invasive airway. For these reasons, rapid IOT sequencing should be performed by anesthesiology personnel, as it should be kept in mind that the pregnant airway is different and requires a smaller caliber endotracheal tube (The American College of Obstetricians and Gynecologists, 2019). Given the edema and physiologic airway narrowing accentuated with the associated pulmonary infectious process, where the target oxygenation and ventilation include considering mild respiratory alkalosis, decreased functional residual volume, increased requirement for end-expiratory expiratory pressure (PEEP) to reach higher plateau pressures due to diaphragmatic compression of the gravid uterus, chest wall compression and breast tissue edema (Bhatraju *et al.,* 2020), it is then imperative to know the monitoring of the mechanical properties of the lung for the prognosis of the disease-causing ARDS and to make the relevant therapeutic decisions. Thus, the measurement of lung function makes it possible to reach optimal conditions during mechanical ventilation and to choose the appropriate time for weaning or disconnection of invasive ventilation; taking into account that, if physiologically in the adult patient, there are elastic and restrictive forces that oppose this process, in the pregnant patient these resistances are increased and the dynamic and elastic characteristics determine the respiratory work with mechanical properties such as compliance or distensibility, resistance and inertia of the lung tissue (The American College of Obstetricians and Gynecologists, 2019).

Physiologic tidal volumes in pregnancy are greater than the target value of 6 ml/kg ideal body weight which translates into a challenge for adequate oxygenation and lung protection; it is for this reason that increased PEEP is required with target PCO_2 and oxygenation, while still allowing alveolar plateau pressures to exceed 35 cm H_2O (Wang X *et al.,* 2020).

The literature describes that the prone position helps to solve significant oxygenation problems in the context of ARDS; in the patient documented in this case, there is evidence of improved oxygenation in the 45° maternal position (Guérin *et al.,* 2013). Demonstrating the safety and feasibility of its use in pregnancy.

There is little information on the risks and benefits of early termination of pregnancy in patients with ARDS due to COVID-19; therefore, it is required to weigh the improvement of maternal respiratory parameters vs. the high risk of preterm delivery; so, each case should be individualized prioritizing maternal stability over fetal status, where the provision of prenatal steroids for pulmonary maturity is recommended in gestations less than 34 weeks (Russell, Millar, Baillie, 2020). In this case, it was evidenced that there was a greater risk than maternal-fetal benefit, associated with the risk of perinatal infection by COVID-19 since the 26s fetus has a semiallogeneic immune tolerance and cannot generate an effective inflammatory response to infection since the passive transfer of maternal protective immunoglobulins is not sufficient until the end of gestation (Zeng *et al.,* 2020).

To date, there are no conclusive studies on the clear association of preeclampsia with COVID-19; however, the references leave the door open for further studies on such concomitance (Hansen, Hine, Strout, 2021).

4. Conclusion

Currently, there are no universal guidelines regarding the approach to the severely ill pregnant patient with ARDS due to COVID-19 requiring invasive ventilatory support; hence, joint care with other specialties (multidisciplinary approach) becomes crucial for a favorable maternal-fetal outcome, where the priority, in addition to the care of the binomial (mother-child) is the care of the team in charge of the treatment and care of this type of patient.

Clinically, the pregnant patient with COVID-19 requires treatment that allows control of ventilatory parameters, including pulmonary ventilation with limited plateau pressure, low tidal volumes, higher PEEP with concomitant supportive therapy, variable maternal position (45° and pronation), cardiopulmonary and fetal hemodynamic monitoring, without forgetting important aspects such as therapeutic anticoagulation that should be extended until the postpartum period.

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Conflict of interest

The authors declare that they have no conflict of interest.

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