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ARTIGO ORIGINAL

Characterization of Clinical Experience and Safety of Anesthetic Approach in Parturients with COVID-19 for Labor, Delivery or Cesarean Section: A Retrospective Observational Study

Caracterização da Experiência Clínica e Segurança da Abordagem Anestésica em Parturientes com COVID-19 Submetidas a Analgesia de Trabalho de Parto ou Anestesia para Cesariana: Estudo Observacional Retrospectivo

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ABSTRACT

Introduction: Coronavirus disease 2019 was declared a pandemic in March 2020. To date there is limited national data about the clinical features, anesthetic management and outcomes of infected pregnant patients. The aim of this study was to characterize the clinical experience and safety of different anesthetic techniques in infected pregnant women undergoing anesthesia or labor analgesia.

Methods: A retrospective study including parturients with positive test for SARS-CoV-2 was conducted. Demographic and epidemiological context, laboratorial tests and radiological imaging at admission were collected. Analgesic/anesthetic procedures, surgery related data and maternal and neonatal outcomes were described, as well as, health status of the involved medical staff in order to identify any complication or infection.

Results: Fifteen patients were included. Symptoms and clinical characteristics were similar to those previously reported. Vaginal delivery and neuraxial analgesia/anesthesia were conducted in most of the cases, in contrast with other reports. Of the patients submitted to epidural analgesia, most of them remained under patient controlled epidural analgesia until birth. Only one case underwent general anesthesia with tracheal intubation. All newborns were negative for SARS-CoV-2. There were no maternal or neonatal complications or critical events. No medical staff were infected throughout the patient care.

Conclusion: In our experience, regional anesthesia techniques for labor analgesia/anesthesia were applied in 93% of the cases. Safety and efficacy of this anaesthetic procedures were verified without maternal or neonatal complications. Effective individual precautions and actuation protocols were important for medical staff protection. This study may be helpful in planning for further obstetric anesthetic management of infected parturients.

RESUMO

Introdução: A doença coronavírus 2019 foi declarada pandémica em março de 2020. Até à data, a evidência nacional sobre a clínica, abordagem anestésica e prognóstico das grávidas infetadas é limitada. O objetivo deste estudo foi caracterizar a experiência clínica e segurança das técnicas anestésicas na abordagem à grávida infetada submetida a técnicas anestésicas ou analgesia de parto.

Métodos: Foi realizado um estudo retrospetivo incluindo todas as parturientes infetadas. Dados sobre o contexto demográfico, epidemiológico, resultados dos estudos laboratoriais e imagem radiológica realizados à admissão foram colhidos. Descreveu-se os procedimentos anestésicos/analgésicos realizados, dados relacionados com a cirurgia, puérpera e neonato, bem como o estado clínico dos profissionais de saúde envolvidos, a fim de identificar complicações.

Resultados: Foram incluídas 15 parturientes. Os sintomas e características clínicas encontrados foram semelhantes aos reportadas previamente. O parto vaginal foi mais frequente e a anestesia/analgesia do neuroeixo foi realizada na maioria dos casos, em contraste com os estudos prévios. Das parturientes sob analgesia epidural, a maioria permaneceu com *patient controlled epidural analgesia* até ao

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parto. Apenas em um caso foi necessária anestesia geral. Nenhum recém-nascido foi infetado com SARS-CoV-2. Não foram reportados complicações ou eventos críticos maternos ou nos recém-nascidos. Nenhum profissional foi infetado durante a prestação de cuidados.

Conclusão: Na nossa experiência, as técnicas regionais para anestesia/analgesia do trabalho de parto foram usadas em 93% dos casos. A segurança e eficácia destes procedimentos foram verificadas sem registo de complicações maternas ou neonatais. A precaução individual e os protocolos de atuação foram importantes para a proteção dos profissionais. Este estudo poderá ser útil para o planeamento futuro da abordagem anestésica em grávidas infetadas.

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is an infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), first reported in Wuhan (Hubei, China) in November 2019 after epidemiological and microbiological investigation of an atypical pneumonia cluster.[1] SARS-CoV-2 belongs to the coronavirus (CoV) family and has a single linear RNA segment. Prior to its identification, two other strains of this family had already been implicated in epidemic outbreaks of zoonotic origin: SARS-CoV (severe acute respiratory syndrome - SARS) and MERS-CoV (Middle East respiratory syndrome -MERS).[1]

Since March 11, 2020, World Health Organization (WHO) declared COVID-19 outbreak a pandemic and the total number of patients infected increased exponentially all over the globe.[2] Portugal followed this trend, with the first infected patient on March.[3] On March 26, by determination of the Portuguese Directorate-General of Health (DGS) the pandemic mitigation phase was established, characterized by the existence of local indoor and community transmission chains.[4]

In addition to the respiratory system, SARS-CoV-2 has tropism for multiple organ systems. Its median incubation period is 5 days, with the possibility of extension up to 14 days after exposure.[5] In 80% of cases, the clinical presentation is characterized by mild to moderate symptoms, without the need for treatment in a hospital environment.[6] Yet, of patients who need hospitalization, it is estimated that 6%-10% require treatment in intensive care units.[7]

Currently, there is limited data regarding SARS-CoV-2 infection during pregnancy and its potential consequences for maternal and perinatal outcomes. However, it is postulated that physiological changes in the respiratory, cardiovascular and immune systems, observed during pregnancy, may contribute to a greater severity of the associated symptoms, especially in the last trimester of gestation.[8] Additionally, in some small data case series, a higher risk of preterm birth was reported.[9] However, to the present date there is no evidence of vertical transmission.[10]

Recently, some published studies evaluated the anesthetic approach of positive SARS-CoV-2 (PSC2) pregnant women and the possible consequences of the infection in the obstetric population.[11] These included their clinical evolution, continuation of pregnancy, type of delivery, occurrence of vertical transmission, isolation of the newborn and breastfeeding.[12] However, taking into account the profile and progression of the pandemic, the literature on this topic is still scarce and limited to case series with few patients. In this way, national and international recommendations are mainly based on reduced degrees of evidence and expert opinion.

Neuraxial approach in pregnant patients with COVID-19 has two fundamental advantages. Firstly, it prevents worsening of the respiratory function related to intubation and mechanical ventilation, and secondly, it protects health professionals involved, since it reduces the risk of exposure to aerosols and transmission of SARS-CoV-2 during airway management.[13] In fact, the risk of exposure for anesthesiologists during the neuraxial approach is presumably low as long as there is no generation of aerosols.[13]

Previous studies on other viral diseases, namely H1N1 influenza and SARS, reported severe respiratory impairment in pregnant women and recognized the risk of meningitis or encephalitis associated with neuraxial procedures in the case of non-treated viremia.[14] It is known that novel SARS-CoV-2 shares many characteristics with other coronavirus, namely neurotropism, which suggests that it is potential neuroinvasive either by direct or indirect mechanisms inherent to systemic infection and either on central or peripheral nervous systems.[15] A retrospective study from Wuhan (China) reported neurologic manifestations of COVID-19 in approximately 36% of patients.[16]

In general, regional anesthetic techniques have been pointed as preferable over general anesthesia. Actually, in case of emergent cesarean section, early placement of epidural catheter is desirable, in order to reduce the likelihood of general anesthesia.[13] Though, hematological changes reported in patients with COVID-19 infection, like thrombocytopenia, must be taken into account before any regional anesthetic technique is considered.[17]

Due to the limited number of published studies concerning the anesthetic approach of PSC2 pregnant patients, a retrospective observational study was conducted at University Hospital Center of São João (UHCSJ), where approximately 2500 births take place annually. The aims of the study were to describe our clinical experience, characterize the safety of the different anesthetic techniques used in pregnant women diagnosed with COVID-19, during labor (spontaneous or induced) and delivery. Furthermore, were analyzed the clinical characteristics of the infection at admission and the implications for the newborn.

MATERIAL AND METHODS

This study was carried out at the Obstetrics Emergency Department of CHUSJ, between March and June 2020, following the approval from the Institutional Ethics Committee.

Clinical and anesthesia records of all pregnant women admitted for scheduled cesarean section, induction of labor or spontaneous labor with a positive test for SARS-CoV-2 were retrospectively analyzed. Demographic, obstetric and neonatal clinical data were analyzed in order to better characterize all pregnant women and neonates included.

The diagnostic criteria for COVID-19 was defined as a positive result for SARS-CoV-2 obtained by reverse transcriptase polymerase chain reaction (RT-PCR) of nasal swab samples. The neonates of these pregnant women were subsequently tested using the same diagnostic criteria.

Epidemiological context and symptoms of infection were assessed in all COVID-19 pregnant patients. Additionally, laboratory findings (including complete blood count) were analyzed. Thoracic computed tomography scan was only performed in patients showing moderate to severe signs and symptoms.

General anesthesia was reserved for cesarean section in the following cases: presence of contraindications to neuraxial techniques, failure of regional anesthetic techniques and emergencies. All data related to the anesthetic technique, administered drugs, vital signs and perioperative complications were collected.

All medical staff involved in clinical care of infected pregnant women were monitored for symptoms. In case of unprotected risk contact or presence of suggestive symptoms, SARS-CoV-2 virus detection test (RT-PCR of nasal swabs) was required by hospital occupational medicine.

Statistical analysis of the collected data was done with Statistical Package for Social Sciences (SPSS)® software, Chicago, Illinois, v26.0. A descriptive analysis of all variables collected was performed. Was used as descriptive statistics for categorical variables, mean ± (standard deviation) for normally distributed continuous variables. For non-normally distributed continuous variables was used median and [interquartile range]. In case of qualitative variables, absolute (n) and relative frequencies (%) were calculated.

RESULTS

Parturients demographic data

From 1st of March to 1st of June 20202, a total of 15 pregnant patients with PSC2 were admitted to our hospital, and all were included in this study. The median age was 32.33 years. Gestational age was ≥ 37 weeks in the majority of patients (93%) at the moment of labor. All of them had presented at least one comorbidity, the most common being anemia (33%) and grade I obesity (13%). All these patients had medical follow-up during pregnancy and their medical conditions were stable during this period. Detailed demographic data are listed in Table 1.

Table 1. Parturients demographic data

Age, years	31.33 (±5.95)
Height, cm	159.13 (±6.12)
Weight, kg	
Early pregnancy	62.29 (±11.25)
Late pregnancy	76.20 (±7.85)
Gestational age	
< 37 weeks, n (%)	1 (7)
≥ 37 weeks, n (%)	14 (93)
Routine prenatal care, n (%)	15 (100)
Coexisting disorders	
Anemia, n (%)	5 (33)
Obesity class I, n (%)	2 (13)
GDM, n (%)	1 (7)
APS, n (%)	1 (7)
Thyroid pathology, n (%)	1 (7)
Asthma, n (%)	1 (7)
Anxiety, n (%)	1 (7)
IBS, n (%)	1 (7)

Data are presented as mean ± standard deviation (SD) or n (%), as indicated.
APS: antiphospholipid syndrome; IBS: irritable bowel syndrome.
Anemia is defined as hemoglobin level of <12 g/dL; Obesity class I was defined as body mass index of 30 to <35 before pregnancy; gestational diabetes mellitus (GDM) was defined as fasting plasma glucose (FPG) ≥5.1 mmol/L and <7.0 mmol/L at first prenatal laboratory evaluation or 2-hour postprandial plasma glucose (2hPPG) ≥7.8 mmol/L between 24th to 28th week of gestation.

Clinical characteristics and exposure to SARS-CoV-2

Of the 15 pregnant women with PSC2 included in the study, only in 7 (47%) was possible to identify positive history of exposure during epidemiological evaluation. Three of them (20%) were completely asymptomatic at the moment of admission. In the remaining 11 patients, cough (60%) and fatigue (13%) were the most common symptoms. However, none of them presented with hypoxemia or need for complementary oxygen at admission (Table 2).

Of the laboratorial analysis performed before delivery, 5 (33%) patients had hemoglobin below 12 g/dL, 9 (60%) leukocytosis, 2 (13%) lymphopenia, 2 (13%) thrombocytopenia and 12 (80%) increase in C-reactive protein (CRP). Eight of included patients performed a pre-defined laboratorial study panel for the PSC2 patients, in accordance with the local guidelines elaborated by Infectious Disease Department. Moreover, only one presented with CoV-SCORE 6 (confirmed COVID-19) and severity index of 48 on chest computed tomography (CT) scan (Table 2).[18]

After delivery, 67% of women with PSC2 had medical follow-up in maternal care unit, 27% were admitted to Infectious

Disease ward to follow their respiratory infections. Only 1 patient worsened her general condition during the puerperium, requiring admission in a Level II Care Unit (where she remained for 3 days) for high-flow nasal oxygen therapy. All of them were discharged from hospital without any complication. At the time of writing of this article, 8 (53%) of the parturients with COVID-19 recovered from the disease with two sequential negative test for SARS-CoV-2 (Table 2).

Characterization of childbirth delivery and anaesthetic technique

Delivery was eutocic in 47% of PSC2 pregnant patients and dystocic in 57% of them. Among dystocic births, 20% were instrumented by a vacuum extraction. The remaining were cesarean deliveries, three of them elective because of fetal abnormal positioning or previous cesarean section and two emergent c-section motivated by nonreassuring pattern on cardiotocography tracing (Table 3).

Most of these parturients with COVID-19 had American Society of Anesthesiologists (ASA) physical status score II, only one had ASA score III (Table 3). Most of these patients (93%) underwent a neuraxial anesthetic technique for labor analgesia and/or anesthesia. Only 1 woman was admitted to delivery room already in the expulsion stage with no time to perform any analgesic technique (Table 3).

Regional techniques were successful in almost all cases and only one cesarean section was under general anesthesia due to failure of a single shot subarachnoid block installation. The most frequently used regional anesthetic technique was epidural for labor analgesia. The latter was achieved satisfactorily using intermittent manual boluses or patient controlled epidural analgesia (PCEA) with programmed intermittent epidural bolus (PIEB) or controlled epidural infusions (CEI). It should be noted that, in most of these patients, an initial manual bolus was performed immediately after the technique and then PCEA was started under PIEB or perfusion regimens (Table 4).

In one of the emergent cesarean section an adequate top-up of previously placed epidural catheter was performed in order to convert labor epidural analgesia to surgical anesthesia. On the other, a conversion to general anesthesia was needed due to failure of a single shot subarachnoid block installation.

All pregnant patients proposed for elective cesarean section were submitted to combined spinal-epidural block by sequential technique (Table 4).

Newborn data

All women had a singleton pregnancy, without any intrapartum or neonatal death (Table 5). Only one newborn was born prematurely (Table 1). The Apgar score ranged from 5 to 9 in the 1st minute and from 8 to 10 in the 5th and 10th minute. With regard to birth weight, the average weight was 3115.38 g and only one newborn had a birth weight below 2500 g (Table 5). All newborns were admitted to the neonatal care unit for further care and all of them were negative for SARS-CoV-2 RT-PCR test. They were discharged from hospital without any complication (Table 5).

Table 2. Clinical characteristics of pregnant women with Covid-19 infection

Epidemiological exposure to SARS-CoV-2, n (%)	7 (47)
Signs and symptoms	
Asymptomatic, n (%)	3 (20)
Cough, n (%)	6 (40)
Fatigue, n (%)	2 (13)
Fever, n (%)	1 (7)
Anosmia, n (%)	2 (13)
Dysgeusia, n (%)	1 (7)
Bell's palsy, n (%)	1 (7)
Laboratory characteristics	
Hemoglobin (<12 g/L), n (%)	5 (33)
Leukocytosis (>10x109 /L), n (%)	9 (60)
Lymphopenia (<1.0x109 / L), n (%)	2 (13)
Thrombocytopenia, (<150x109 / L), n (%)	2 (13)
Elevated concentration of CPR (>3 mg/ L), n (%)	12 (80)
Total proteins (g/L)*	56.54 (±12.88)
Albumin (g/L)*	28.62 (±5.95)
AST (U/L)*	42.63 (±36.52)
ALT (U/L)*	49 (±69.87)
GGT (U/L)*	15.14 (±8.47)
ALP (U/L)*	157.88 (±39.5)
Total bilirubin (mg/dL)*	0.49 (±0.28)
Conjugated bilirubin (mg/dL)*	0.11 (±0.09)
LDH (U/L)*	206.50 (±71.73)
CK (U/L)*	91 (±127.95)
Glucose (mg/dL)*	77.38 (±28.69)
BUN (mg/dL)*	19.50 (±11.17)
Scr (mg/dL)*	0.48 (±0.15)
Na+, mmol/L*	137 (±3.66)
K+, mmol/L*	3.65 (±0.72)
Cl-, mmol/L*	108.25 (±7.98)
CT evidence of SARS- CoV-2 infection, n (%)**	1 (7)
Hospital outcomes after delivery	
Maternal care unit,n (%)	10 (67)
Infectology care unit,n (%)	4 (27)
Intensive care unit, n (%)	1 (7)
Cure, n (%)	8 (53)

Data are presented as mean ± standard deviation (SD) or n (%), as indicated.
ALT: alanine transaminase; AST: aspartic transaminase; BUN: urea nitrogen; CK: creatine kinase; CRP: C-reactive protein; CT: computed tomography; SARS- CoV-2: severe acute respiratory syndrome coronavirus 2; SCr: serum creatinine; LDH: lactate dehydrogenase; ALP: alkaline phosphatase; GGT: gamma-glutamyl transpeptidase; Cure is defined by two consecutive negative RT-PCR swab test for SARS-CoV-2
* Laboratory data was available for 8 pregnants
** CT was available for 1 pregnant

Table 3. Characterization of childbirth delivery

Delivery	
Eutocic, n (%)	7 (47)
Assisted	
Vacuum extraction, n (%)	3 (20)
Elective caesarean, n (%)	3 (20)
Emergent caesarean, n (%)	2 (13)
ASA	
II, n (%)	14 (93)
III, n (%)	1 (7)
Childbirth delivery complications	
Intrapartum fever, n (%)	1 (7)
ASA: American Society of Anesthesiologists	

Table 4. Anesthetic techniques characterization

Anesthetic technique		
None, n (%)		1 (7)
General Anesthesia, n (%)		1 (7)
Epidural block, n (%)		10 (67)
Combined spinal-epidural block, n (%)		3 (20)
Drugs used in regional techniques		
Combined spinal-epidural block (n=3)	Intrathecal levobupivacaine 0.5% (11 mg) + sufentanil 4 µg single shot, n (%)	3 (100)
Epidural (n=10)	Ropivacaine 0.15% + sufentanil 0.2 ug/mL (manual bolus), n (%)	1 (11)
	Ropivacaine 0.15% + sufentanil 0.2 ug/mL (PCEA PIEB), n (%)	6 (56)
	Ropivacaine 0.15% + sufentanil 0.2 ug/mL (PCEA perfusion), n (%)	3 (33)
PCEA: patient controlled epidural analgesia; PIEB: programmed intermittent epidural bolus		

Table 5. Newborn data

Live birth, n (%)	15 (100)
Sex	
Female	9 (60)
Male	6 (40)
Apgar Score	
1 minute	9 [5-9]
5 minute	10 [8-10]
10 minute	10 [8-10]
Birth weight, g	3112 (±409.85)
Low-birth weight (<2500 g), n (%)	1 (7)
SARS-CoV-2 positive, n (%)	0
Neonatal care unit, n (%)	15 (100)

Data are presented as mean ± standard deviation (SD) or n (%), as indicated.
ALT: alanine transaminase; AST: aspartic transaminase; BUN: urea nitrogen; CK: creatine kinase; CRP: C-reactive protein; CT: computed tomography; SARS- CoV-2: severe acute respiratory syndrome coronavirus 2; SCr: serum creatinine; LDH: lactate dehydrogenase; ALP: alkaline phosphatase; GGT: gamma-glutamyl transpeptidase; Cure is defined by two consecutive negative RT-PCR swab test for SARS-CoV-2
* Laboratory data was available for 8 pregnants
** CT was available for 1 pregnant

Complications

There were no anesthetic and/or obstetric adverse events and, as mentioned above, only 2 pregnant patients underwent emergent cesarean section. Additionally, there were no complications in all PSC2 pregnant patients submitted to anesthetic techniques for analgesia and/or anesthesia. Moreover, supplemental oxygen in the immediate postoperative period was not necessary for those patients undergoing cesarean section under regional anesthesia. Only one case had intrapartum fever, however without any further consequence for mother or newborn (Table 3).

No serious newborn complication was observed at the moment of delivery.

DISCUSSION

During the retrospective evaluation period, fifteen PSC2 pregnant patients in labor, spontaneous or induced, were admitted to our hospital. Positive epidemiological context was identified in 46% of them, which is a value higher than that previously reported by Chen *et al.*[11] However, all had a previous stable clinical condition.

Cough was the most prevalent symptom (40%) as for prior reports. Only one pregnant patient presented with Bell's palsy at admission, a neurological sign already reported to be associated to coronavirus disease.[18]

Laboratorial alterations verified on complete blood count at admission, namely leukocytosis, lymphopenia and thrombocytopenia, were in concern with previous available reports. Also, elevation of C-reactive protein accounting for approximately 80% had already been reported by W. Guan *et al.*[19] Other laboratorial alterations were less common.

Vaginal delivery was conducted in most of cases, in contrast with other reports by Parazzini *et al.*[20] Indication for cesarean delivery due to worsening of maternal respiratory infection condition was verified in one case. All the others cesarean sections were motivated by obstetric indications.

Common anesthetic procedures in obstetrics were perceived as more difficult to perform due to personal protective equipment (PPE), not only because of its implications in the technique itself, but also because of the time spent to adequately don and remove.[21] For example, for the scenario of an epidural technique, PPE was constituted by surgical gown, two pairs of gloves, FFP2 or N95 mask and eye protection. This increased difficulty is of utmost importance in emergent or critical situations in which the additional time needed should be taken into account and all the efforts must be done to avoid delays.[21] Indeed, education and training in PPE as well as working closely with obstetric staff were primordial aspects in handling these cases.

Currently, the use of neuraxial anesthesia is not contraindicated for patients with COVID-19.[17] In our practice, early epidural - during the first hours of the first stage of labour - analgesia

was encouraged in order to reduce respiratory exhaustion in mild to severe symptomatic women with labor pain and to decrease the need for general anaesthesia in case of emergent delivery becomes needed.[13]

Routine indications and contraindications were applied to women with confirmed or suspected COVID-19 infection. However, because mild thrombocytopenia appears to be common in non-pregnant patients admitted to hospital with COVID-19, all pregnant women with suspected or confirmed COVID-19 in labor, spontaneous or induced, had a complete blood count at hospital admission.[21] Only 13% of pregnant patients in our study had platelet count of $<150x10^9$/L, minimum reported $131x10^9$/L. Despite that, in any of them absolute contraindications for neuraxial anaesthesia were present.

Most of these patients (93%) underwent a neuraxial anesthetic technique for labor analgesia and/or anesthesia similar as reported by Bauer *et al*.[13,14] Of the patients submitted to epidural analgesia (n=10), 90% remained under PCEA until labor, either in intermittent bolus or perfusion regimens. PCEA allowed a satisfactory pain control in all patients and also minimized the amount of close contacts with the patient, thus ensuring both adequate labor analgesia and team safety. There were no complications resulting from the anesthetic techniques used. The only intercurrence was failure of a single shot subarachnoid block installation in one emergent cesarean section and, consequently, need for conversion to general anesthesia. This was the only case in which there was a need to invasively approach the airway, yet all security conditions were ensured.

Concerns about general anesthesia are due not only to the risk of healthcare worker infection but also to the risk associated with tracheal intubation in patients with some degree of respiratory compromise associated to acute respiratory infection by SARS-CoV-2.

Moreover, increased risk of difficult airway is well recognized in pregnant patients, which could exacerbate the supra mentioned risks.[22]

Admission in level II care unit was only necessary in one case due to respiratory status deterioration. On the remaining patients, any other complications were reported until hospital discharge.

Despite pneumonia and respiratory decompensation were not present in the majority of COVID-19 patients during labor, superior level of care may become necessary in the postpartum. Thereby, additional considerations for this period should include cautious surveillance for respiratory deterioration, adequate fluid management and early involvement of infectious diseases and critical care units.[14]

Cure was verified in 53% of all patients included, until the moment of writing.

In respect to the newborns of the included infected patients, all of them were negative for SARS-CoV-2, which makes vertical transmission unlikely and corroborates existing evidence.[21,23,24] Nevertheless, measures should be taken to prevent newborn infection.

In summary, managing COVID-19 pregnant patients presents unique challenges to the Anesthesiologist and highlights the importance of institutional protocols, standardized care, infection control measures and essential non-technical skills (like teamwork and communication) on daily clinical practice.

In our experience, regional anesthesia techniques for labor analgesia and/or anesthesia were the first line option for management of SARS-CoV-2 positive pregnant patients and were applied in 93% of the cases, which allowed to avoid approaching the airway in most cases. Of the patients submitted to epidural analgesia, 56% of them remained under patient controlled epidural analgesia with ropivacaine 0.15% + sufentanil 0.2 ug/mL until birth.

All newborns were admitted to the neonatal care unit for further care, however any of them were tested positive for SARS-CoV-2. Safety and efficacy of all anesthetic techniques were verified by absence of maternal or neonatal complications during procedure and in the first 48 hours.

That, in addition to establishment of circuits for SARS-CoV-2 positive patients, elaboration of protocols and training of healthcare workers in order to ensure proper use of PPE, may have contributed to minimize postoperative complications (namely, respiratory compromise) and to the absence of known infection of healthcare workers involved in the care of these patients.

This study was the first national characterization of anesthetic management of COVID-19 pregnant women and may be helpful in planning for further obstetric anesthetic procedures and future comparison between institutions.

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