Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Original Article

Clinical, obstetrical and anaesthesia outcomes in pregnant women during the first COVID-19 surge in France: A prospective multicentre observational cohort study

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ABSTRACT

Introduction: Clinical outcomes and critical care utilisation associated with Coronavirus Disease 2019 (COVID-19) in obstetric patients remain limited particularly in relation to severe cases.
Methods: A retrospective multicentre cohort study was conducted during the first wave of COVID-19 in France in 18 tertiary referral maternity units. Consecutive women with confirmed or suspected COVID-19 during pregnancy or the delivery hospitalisation were included between March and July 2020 (17-week period). We report clinical, obstetrical and anaesthetic outcomes of pregnant women with COVID-19 and report the prevalence of severe forms and risk factors for respiratory support in this cohort.
Results: There were 126 included cases; RT-PCR testing occurred in 82 cases, of which 64 (78%) had a positive test. The caesarean section rate was 52%, and preterm delivery (< 37 weeks) rate was 40%. Neuraxial anaesthesia was performed in 108 (86%) cases with an increasing proportion compared to general anaesthesia over time ($p < 0.0002$). Twenty-eight cases received oxygen supplementation (nasal oxygen therapy or mechanical ventilation); the SOFAresp score was associated with gestational age at the time of COVID-19 presentation ($p = 0.0036$) and at delivery ($p < 0.0001$). Postpartum intensive care unit (ICU) admission occurred in 21 cases (17%) with 17 (13%) receiving invasive or non-invasive ventilation. Pre-delivery factors associated with postpartum ventilation were oxygen support, oxygen saturation and haemoglobin levels.
Conclusion: In our cohort, COVID-19 was associated with significant maternal morbidity resulting in high ICU admission rates (17%) and invasive or non-invasive ventilation utilisation (10%).

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1. Introduction

It has been challenging to report on the management and clinical outcomes in obstetric patients with severe Coronavirus Disease 2019 (COVID-19) and robust data remain relatively limited despite the global pandemic [1–3]. In previous viral pandemics such as severe acute respiratory syndrome coronavirus (SARS) and H1N1, pregnant women were more susceptible to serious illness and mortality than the general population [4,5] and had a high risk of adverse perinatal outcomes [6,7]. In a report on over 90,000 pregnant and non-pregnant women with COVID-19 in the United States, pregnancy was associated with severe COVID-19 as determined by the intensive care unit (ICU) admission rate and increased use of mechanical ventilation [8]. However, the 0.2% mortality rate associated with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection was the same in pregnant and non-pregnant women with similar reproductive age. This rate was however much lower than the one reported in the general adult population (2.9–3.6%) [9].

Reports on the anaesthetic management and critical care utilisation of pregnant women with COVID-19 are even more scarce [10–12]. Therefore, the main objectives of our study were to (i) report clinical, obstetrical and anaesthetic outcomes of pregnant women with COVID-19 at the time of labour and delivery and (ii) identify the prevalence of severe forms and risk factors for respiratory support in this population.

2. Material and methods

This retrospective multicentre cohort study collected data from all consecutive pregnant women who delivered between March and July 2020 (17 weeks data collection), during the first wave of the pandemic, in 18 tertiary referral maternity units (birthing centre with on-site neonatal ICU) in France.

This study was approved by the Institutional Review Board (IRB) of the French Society of Anaesthesia and Intensive Care Medicine (SFAR, Société française d'anesthésie et de réanimation, IRB 00010254-2020-045). The study was also registered as "COVID Anesthésie" under the number 20200716194220 in the registry of the Paris Hospitals (Registre APHP, Assistance Publique-Hôpitaux de Paris).

All consecutive pregnant women with confirmed or suspected COVID-19 admitted in each site for vaginal delivery or caesarean section under neuraxial or general anaesthesia were included. Excluded from study enrolment were pregnant women (i) admitted for abortion, miscarriage or other non-obstetric procedure, (ii) seen at 36 weeks' gestation antenatal anaesthesia consultation (required by French regulation) or any consultation for maternal or obstetric disease without anaesthesia care during the study period, or (iii) admitted for delivery but not receiving anaesthesia care. COVID-19 was diagnosed according to the World Health Organization (WHO) guidelines [13].

Maternal demographics, comorbidities, obstetrical, anaesthetic, and COVID-19 characteristics were extracted from electronic medical health records and recorded on a case-report form (see APPENDIX). Respiratory function was assessed according to the respiratory component of the sequential organ failure assessment score (SOFAresp), the PaO2/FiO2 (mmHg) ratio, with a score 0 = ≥ 400, score 1 = < 400, score 2 = < 300, score 3 = < 200 with mechanical ventilation, score 4 = ' < 100 with mechanical ventilation [14]. The cases were grouped into two categories: SOFAresp score 0–1 considered non-severe and SOFAresp score 2–4 considered severe.

Statistical analysis was performed with R. Depending on the normality of data, quantitative variables are expressed as mean and standard deviation or median and range. Qualitative variables are expressed as frequency or percentage with 95% confidence interval (CI95) when needed.

To identify predictors for postpartum mechanical ventilation in the subgroup with a pre-delivery SOFAresp score < 2 (with no or non-severe respiratory failure), and because of the large number of variables in this small cohort, and the unbalanced nature of data, we used the Random Forest algorithm, stratified by centre [15]. Random Forest measures a distance metrics rather than a statistical dependence between variables. This machine-learning algorithm does not over fit, even when the outcome is unbalanced, and the number of variables is important. The measure of variable importance is reported as the mean decreased accuracy to avoid bias [16]. However, because accuracy, which is the ratio of correct classification, is not strictly inferential, comparisons of the haemoglobin content between ventilated *versus* non-ventilated groups were conducted using the Student's *t*-test.

Trends in delivery mode (vaginal *versus* caesarean section) or anaesthetic modality (general anaesthesia with or without prior neuraxial anaesthesia *versus* neuraxial anaesthesia only) were compared using the log Rank test. Comparisons between groups were performed using either a Chi-square test, a Student's *t*-test or a Mann-Whitney *U* test. A Bonferroni correction was applied as appropriate. Correlations between severity of COVID-19 (assessed with SOFAresp) and the gestational age at the time of COVID-19 and gestational age at delivery were performed using Kendall rank correlation.

3. Results

During the 17-week study period, there were 126 obstetric patients meeting inclusion criteria (Fig. 1). During this time period, 15,392 deliveries occurred in all 18 centres. COVID-19 had been diagnosed during pregnancy or the delivery hospitalisation, with an onset occurring between 115 and zero days before delivery.

3.1. Obstetrical and delivery outcomes

Demographic and pregnancy characteristics are reported in Table 1.

Vaginal delivery occurred in 61 cases (48.4%), of which 55 had an uncomplicated postpartum recovery on the regular unit (90.2%).

Though a total of 65 women delivered with a caesarean section over the study period yielding a caesarean section rate of 52%, there was a significant decrease in the caesarean section rate over time, from 82.8% in March to 21% in May-July ($p < 0.0005$) (Fig. 2).

Preterm delivery (< 37 weeks gestation) occurred in 53 cases (42%), of which 18 occurred between 23- and 31-weeks gestations. There was no neonatal death.

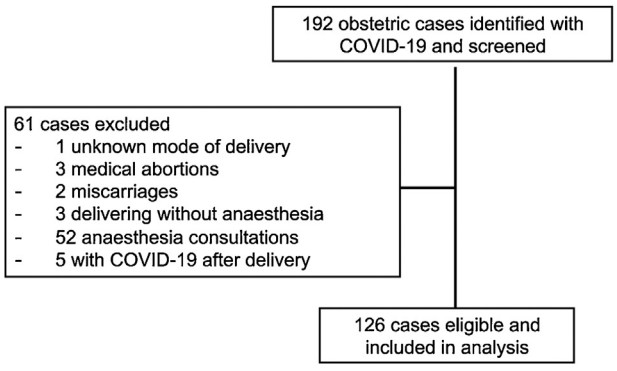

Fig. 1. Flow diagram.

Table 1
Demographic and pregnancy characteristics.

Characteristics	
Age (years)	33 ± 7
BMI (kg/m^2)	27 ± 6
Comorbidities	
Obesity	27/114 (24%)
Diabetes Mellitus	9/126 (7%)
Hypertension	5/126 (4%)
Thromboembolic risk factors	7/124 (6%)
Other comorbidities: Kidney Transplantation 4, Smoking 2, Mechanical heart valve 1, Acute fatty liver 1, Asthma 1, Venous thromboembolism 1, Sickle Cell Disease 1	
Pregnancy-associated conditions	
Nulliparity	23/122 (19%)
Multiple pregnancy	8/126 (6%)
Gestational diabetes	33/126 (27%)
Preeclampsia	12/126 (10%)
Obstetric cholestasis	4/126 (3%)
Pregnancy-induced hypertension	2/126 (12%)
HELLP syndrome	1/126 (1%)
Medications	
Corticosteroids (foetal indication)	14/126 (11%)
Corticosteroids (maternal indication)	4/126 (3%)
Antiviral therapy	9/126 (7%)
Insulin	6/126 (5%)
Immunosuppressive drugs	1/126 (1%)
Aspirin	1 /126 (1%)

Data presented as mean ± standard deviation, or n/N (%).
n = number of cases with the variable, N = total number of cases (missing values), BMI = body mass index.

Postpartum haemorrhage was the most frequent obstetrical complication and was observed in 18 cases (14.3%) leading to transfusion of blood products in 12 cases (9.5%). There were 5 cases with a surgical re-intervention and 2 cases of wound infection. Acute renal failure occurred in 9 cases.

3.2. COVID-19 characteristics

Fever and clinical pneumonia were present in 63 of 126 cases (50%), with 19 patients receiving antibiotic therapy (15%).

The median time for onset of symptoms prior to delivery was 12 [0–115] days in 102 cases (24 missing values). RT-PCR testing was performed in 82 cases (65%); of these, 64 (78%) were positive although 11 were asymptomatic, with universal testing strongly recommended in France as of the 19th of May 2020 [17].

COVID-19 was diagnosed in 3rd trimester in 79 cases (63%), in 2nd trimester in 44 cases (35%), and 1st trimester in 1 case (two missing values).

The preterm delivery rate was higher among cases with a SOFAresp score > 0 (N = 21/27, 78%) compared to cases with a SOFAresp score of 0 (N = 32/99, 32%). There were significant correlations between the SOFAresp score and the gestational age at the time of COVID-19 (p = 0.0036) and SOFAresp score and gestational age at delivery ($p < 0.0001$). There was also a strong correlation between the SOFAresp score and caesarean section (p = 0.0004). Caesarean section was most often performed in cases treated with oxygen supplementation (79%) (Table 2).

After delivery, 21 cases (17%) were admitted to ICU and 17 (13%) required respiratory support (invasive or not) (Table 3). Twenty-eight cases received nasal oxygen therapy (4 [2–15] L/min), and intubation and mechanical ventilation subsequently occurred in 4 cases. Pre-delivery respiratory function, as assessed with SOFAresp score, was non-severe in a majority of women; the score was 0 in 99 cases (78.6%), 1 in 16 cases (12.7%), and categorised as severe with a score at 2 in 7 cases (5.6%), at 3 or 4 in 1 and 3 cases respectively (3.1%) (Fig. 3). Among the 115 cases with non-severe SOFAresp score (0–1), 9 received postpartum ventilation (Table 4). The variables associated with post-delivery ventilation were antepartum oxygen therapy, oxygen saturation and haemoglobin content (Table 4). The haemoglobin content was significantly lower in cases with ventilatory support when

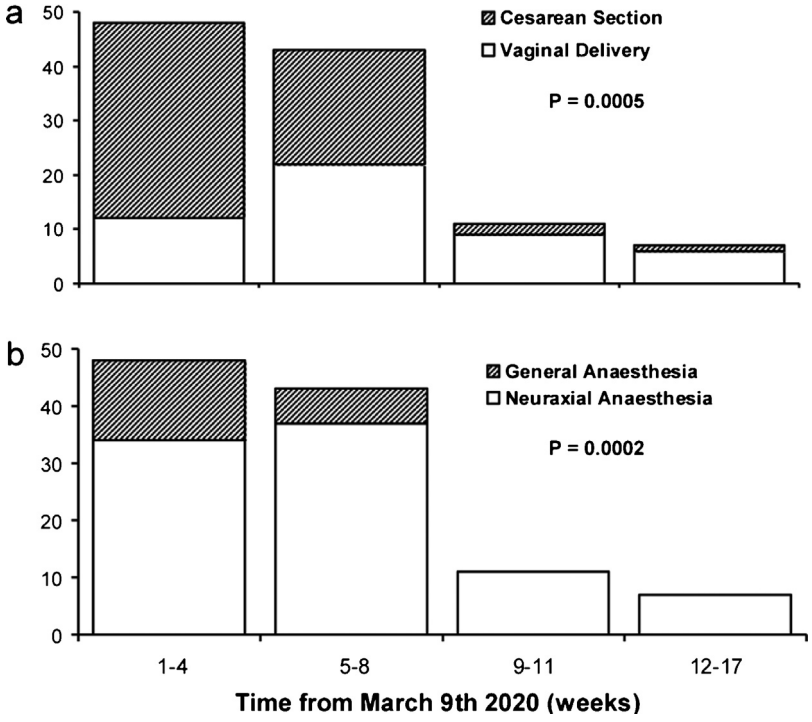

Fig. 2. a) Delivery mode (vaginal *versus* caesarean section) as function of time (N = number of cases). b) Anaesthesia mode (general anaesthesia with or without neuraxial anaesthesia *versus* neuraxial anaesthesia only) as function of time (N = number of cases).
Comparisons (trend with time) performed using the log rank test.

Table 2
Characteristics at delivery.

Characteristics	
Gestational age (weeks)	38 [23–41]
Gestational age < 37 weeks	53/126 (42%)
COVID-19 associated symptoms during labour or caesarean section	
Temperature > 38 °C	21/95 (22%)
Clinical presentation of pneumonia	62/123 (49%)
Obstetric characteristics & delivery mode	
Induced labour	32/126 (26%)
Vaginal delivery	61/126 (48%)
Caesarean section	65/126 (52%)
Caesarean section due to maternal respiratory status [a]	23/65 (35%)
Caesarean section code: green/orange/red	35/21/8 (N = 64)
Duration of caesarean section (min)	45 [21–95]

Data presented as median [range] or n/N (%).
n = number of cases with the variable, N = total number of cases analysed for the variable, Caesarean section code green = delivery within 45 min; code orange = - delivery within 30 min; code red = delivery within 15 min.
[a] Cases with oxygen supplementation or mechanical ventilation.

Table 3
Severity of COVID-19 after delivery.

COVID-19 Severity Characteristic	
ICU admission [a]	21/126 (17%)
Acute renal failure	9/126 (7%)
Sepsis (wound sepsis)	2/109 (2%)
Total SOFA score	0 [0–12]
Death	1/126 (1%)
Respiratory support	17/226 (13.5%)
High-flow nasal cannula oxygen therapy	2/126 (2%)
Mechanical ventilation	15/126 (12%)
Length of mechanical ventilation (days)	9 [0–59]
ECMO	1/126 (1%)

Data presented as median [range] or n/N (%).
N = number of cases with the variable, N = total number of cases analysed for the variable ICU = Intensive Care Unit SOFA = Sequential Organ Failure Assessment, ECMO = Extracorporeal Membrane Oxygenation.
[a] This number includes antepartum ICU admissions.

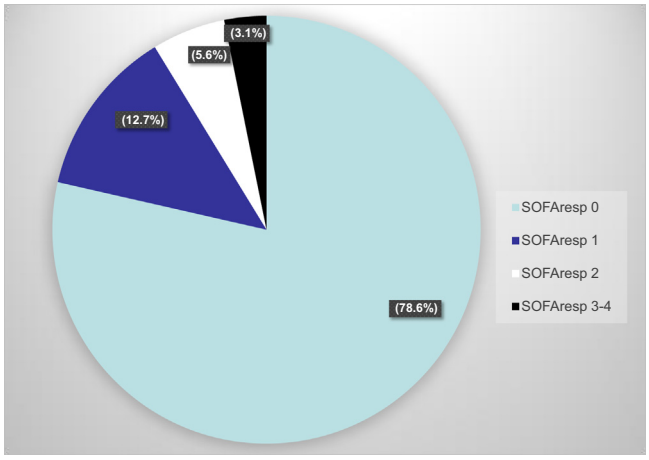

Fig. 3. Sequential Organ Failure Assessment Respiratory (*SOFAResp*) Score.
SOFAresp score: 0–1 considered non-severe.
SOFAresp score: 2–4 considered severe.

compared to those who did not (10.2 ± 1.1 g/dL *vs.* 11.4 ± 1.2 g/dL, $p = 0.0007$).

There was one maternal death in a patient with a history of renal transplantation with immunosuppressive therapy; she had severe COVID-19 (pre-delivery SOFAresp score of 4) requiring mechanical ventilation and extracorporeal membrane oxygenation (ECMO), and she died on the 28th day postpartum in the setting of multiple organ dysfunctions.

There were 33 cases receiving postpartum psychological or psychiatric support.

Table 4
Pre-delivery variables associated with postpartum ventilation in cases with non-severe SOFAresp score.

Variable	Mean Decreased Accuracy
SpO_2	20%
O_2	18%
Hb [a]	12%

There were 9 cases with postpartum ventilation (2 cases with non-invasive and 7 cases with mechanical ventilation) among the 115 cases with non-severe pre-delivery SOFAresp score (score 0–1).
The three variables with a mean decreased accuracy >10 are reported; accuracy is the ratio of correct classification.
[a] Cases with postpartum ventilation had a lower haemoglobin content compared to cases with no ventilation (Student's *t*-test).

Table 5
Anaesthetic management.

Anaesthetic mode	Total cases (N = 126)
Epidural	69 (55%)
Spinal	31 (25%)
Combined spinal-epidural	6 (5%)
General	18 (15%)
Neuraxial and general	2 (2%)
Airway characteristics in caesarean section cases with general anaesthesia	N = 20
Difficult intubation	2/16 (18%)
Video laryngoscopy	11/16 (69%)
Closed suction system	8/20 (40%)

Data presented as number of cases with the variable.

3.3. Anaesthesia management

By enrolment criteria, all cases received anaesthesia for delivery (Table 5).

Overall, neuraxial anaesthesia was performed in a total of 108 cases (86%).

Neuraxial labour analgesia was provided in 60 cases (47.6%) and maintained with continuous epidural infusion or programmed intermittent epidural bolus (PIEB), with patient controlled epidural analgesia (PCEA).

There were 20 cases of general anaesthesia for delivery resulting in a rate of general anaesthesia for caesarean section of 27.7% (20/65). The rate of general anaesthesia decreased over time ($p < 0.0002$; Fig. 2), and the trend remains significant ($p = 0.0127$) with survival analysis for the caesarean section group.

4. Discussion

In this retrospective multicentre cohort study reporting on 126 cases during the first COVID-19 surge in France, SARS-CoV-2 infection in pregnancy was associated with significant maternal morbidity resulting in an ICU admission rate of 17%, mechanical ventilation rate of 12%, use of ECMO in 1 case, and one maternal death. Our findings are consistent with other reports of increased rates of preterm delivery among women with COVID-19, also associated with respiratory function as assessed with SOFAresp score. At the start of the pandemic, an increased rate of caesarean delivery was observed but this rate progressively declined over the

17 weeks period, as was the case for the ratio of general anaesthesia/neuraxial anaesthesia for caesarean delivery.

The ICU admission rate of 17% is within the upper range of what has been reported in previous studies in which the incidence ranged between 4.7% and 13% [1,18–20], although in a large report from the United States covering the same study period, it was as high as 16% in a cohort evaluating symptomatic pregnant women [19]. A possible explanation for the relatively high ICU admission rate in our cohort, despite the relatively high proportion of non-severe pre-delivery SOFAresp score (0–1 in 91% of cases) is the relative availability of ICU beds in France compared to other countries, and how high dependency (''ICU beds'') are defined. Indeed, in our study, ICU admission also included high dependency units. As in previous reports, the need for mechanical ventilation in 15 cases (12%) with a median length of 9 days was the most common criteria of COVID-19 severity. This rate is higher than previously reported (ranging from 3.8% to 4.7%) [19,21], even among symptomatic cases (8.5%) [19]. It has been reported that among women of reproductive age with COVID-19, pregnant women were more likely to be treated with mechanical ventilation compared to non-pregnant ones [8]. Pre-existing physiological factors such as atelectasis, lower lung reserve and increased oxygen consumption may predispose pregnant women to adverse outcomes during any respiratory illness [22]. Another potential reason for the high ICU admission rate and for the increased use of ventilatory support is a higher level of concern for hypoxaemia in pregnant women when a fetus is *in situ*. Consistent with the 1% reported maternal death rate among pregnant women with COVID-19 [23] and in a recent British report [20], there was one maternal death in our cohort in a patient with serious pre-existing comorbidities.

Preterm delivery occurred in 4 out of 10 women in our cohort. The preterm delivery rate in pregnant women with COVID-19 is highly variable, ranging between 13 and 43% [18–21,24]. The fact that all pregnant women included in the study were admitted in tertiary referral centres could in part explain this high rate, consistent with reports of a three-fold increase in preterm deliveries among symptomatic COVID-19 women compared to asymptomatic pregnant women [19].

In the present study, caesarean section was performed in 50% of deliveries. This rate is in the range of what has been observed in the most recent studies [1,20,21]. Nearly 85% of patients, who had caesarean section in our cohort, were those who needed oxygen therapy. This indication was much more frequent than in previous studies (16–25%) [20,21]. However, it is difficult to compare different populations with different respiratory status. About 13% of caesarean sections performed during the study period were emergency procedures (*i.e.*, in a context of immediate threat to life of mother or foetus). Of note, we observed a progressive reduction of the rate of caesarean section during the inclusion period and the proportion was the highest in March 2020 (80%), and the lowest in June 2020 (20%). This trend is probably due to the fact that the impact of COVID-19 on pregnant women and the foetus was not well known at the beginning of the pandemic and attitudes were in accordance with a suspected increased risk in pregnant women, as seen in previous pandemics [5,6]. A similar high use has been reported in the first Chinese case series in which the rate of caesarean section reached more than 90% during the initial part of the pandemic [18]. By contrast, a recent retrospective study in New York describing outcomes between March and April 2020 did not report an increased rate of caesarean section [25]. Several recent studies have also reported uneventful vaginal deliveries in pregnant women with COVID-19 [1,20]. Furthermore, there is reasonably good evidence to suggest that vertical transmission from pregnant women to the foetus is unlikely or minimal [26,27]. Finally, our data support the idea that obstetric management has rapidly evolved towards going back to "normal" practice in terms of delivery mode.

Neuraxial analgesia or anaesthesia was provided for labour and/or caesarean section to over 80% of cases, consistent with usual rates in France [28]. Early labour epidural analgesia is recommended to reduce respiratory exhaustion in mild to severe symptomatic women and is advocated to decrease the odds for general anaesthesia in case of emergent delivery [29].

The French Society of Anaesthesia and Intensive Care (SFAR) recommends that a closed suction system should be readily available before tracheal intubation, and that videolaryngoscopy should be considered as first-line device for airway management to minimise exposure with the patient's respiratory tract [29]. Despite these recommendations, a closed suction system was used in less than half of general anaesthetics and videolaryngoscopy was used in only 11 cases. There were 2 cases of difficult intubation among the 21 cases receiving general anaesthesia.

The median time interval from start of symptoms to admission for delivery was 12 [0–115] days. Few studies have reported data on this time interval. Our data suggests that women with mild COVID-19 early in pregnancy might fully recover before delivery. However, as in previous studies [18,21], most patients in our cohort were in the 3rd trimester of pregnancy at the time of the COVID-19 diagnosis.

In our cohort, and by study design, most women (87%) were symptomatic before delivery. We evaluated pre-delivery variables that may help predict the need for postpartum respiratory support; indeed, antepartum oxygen therapy, oxygen saturation and haemoglobin content were associated with severe respiratory failure. Interestingly, the haemoglobin content was significantly lower in patients who needed ventilatory support when compared to those that did not.

Postpartum haemorrhage (PPH), as defined by a blood loss $>$ 500 mL, was the leading postpartum complication with a rate of 14%. Several studies reported PPH have investigated such outcome in pregnant women with COVID-19 [30,31]. A rate of postpartum haemorrhage ($>$ 1000 mL) of 9% was observed in a cohort of 64 pregnant women with COVID-19 [30]. This rate reached 13% in the severe disease group (n = 44) and 6% in the critical disease group (n = 20) [30]. Nevertheless, in a retrospective cohort study which included 53 pregnant women with COVID-19 and 760 non-COVID-19 pregnant women, it was reported that deliveries associated with COVID-19 were not at increased risk for increased blood loss or obstetric haemorrhage compared with deliveries without COVID-19 [31].

We acknowledge several limitations to our study. First, the retrospective nature of data collection precludes firm causal association and findings should be interpreted as descriptive. Second, data were collected in tertiary referral centres. Consequently, the morbidity rate observed may overestimate the acuity of COVID-19 presentation in pregnant women: indeed, some patients were referred because they already required oxygen therapy or were in critical condition. Third, asymptomatic or pauci-symptomatic cases might have been missed, especially at the start of the study period, since COVID-19 screening was not systematically done and systematic universal testing was only recommended in France as of the 29th of May 2020 [17].

5. Conclusion

This multicentre retrospective cohort study during the first COVID-19 surge in France suggests that COVID-19 is associated with significant maternal morbidity and need for ICU level of care. Postpartum mechanical ventilation utilisation was correlated with antepartum oxygen therapy, oxygen saturation and haemoglobin

levels, which could serve as triggers for transferring patients to centres with appropriate maternal care levels.

Human and animal rights

The authors declare that the work described has been carried out in accordance with the Declaration of Helsinki of the World Medical Association revised in 2013 for experiments involving humans as well as in accordance with the EU Directive 2010/63/EU for animal experiments.

Informed consent and patient details

The authors declare that this report does not contain any personal information that could lead to the identification of the patient(s).

Disclosure of interest

The authors declared no conflict of interest.

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None.

Author contributions

All authors attest that they meet the current International Committee of Medical Journal Editors (ICMJE) criteria for Authorship.

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Appendix. Data collected for the study

Patient reference in the study
Hospital
Academic hospital
Transferred from
Age at time of the procedure
Date of the procedure
Time of the procedure
Call
Length of OT stay
Term (weeks of gestation)
Parity
Singleton fetus
Pregnancy-induced hypertension
Preeclampsia
HELLP syndrome
Intrahepatic cholestasis of pregnancy
Gestational diabetes
Risk factors for thrombosis
Other previous disease
COVID-19 test before surgery
COVID-19 status before delivery
Date of first symptoms
COVID-19 status (final)
Viral pneumonia
Temperature $>$ 38 °C
Maximum number of healthcare providers in the OT
Smoking
ASA score
Hypertension
Body Mass Index
Diabetes
Immunosuppressant drugs
Steroids (maternal indication)
Steroids (fetal indication)
NSAID
Insulin
Antiviral
SOFA - Resp
Creatinine
Haemoglobin
Leukocytes
Lymphocytes
Prothrombin time
Activated partial thromboplastin time (APTT)
Fibrinogen
Platelet count
D-dimers
Other coagulation data
SpO2 before delivery
If mechanical ventilation: FiO2 (%)
If no mechanical ventilation: O2 L/mn
Transfer from another institution
Induction of delivery
Mode of delivery
Mode of delivery: detail
Mode of anaesthesia
If vaginal delivery: mode of anaesthesia
If vaginal delivery: type of epidural
If vaginal delivery: quality of the analgesia
If caesarean: type of analgesia
If caesarean: Length
If caesarean under regional anaesthesia: quality
If caesarean under general anaesthesia: use of videolaryngoscope
If caesarean under regional anaesthesia: difficulty with intubation
If caesarean under general anaesthesia: closed loop aspiration
Hypoxaemia
If hypoxaemia: tracheal intubation needed
If hypoxaemia without intubation: O2 L/mn
Other obstetrical event
Postpartum haemorrhage
Transfusion
Postpartum Thromboprophylaxis
If yes: type of thromboprophylaxis
Site of hospital stay after delivery
Organisation: preparation before delivery
Organisation: PPE
Organisation: One midwife
Organisation: Both parents present
Alive at birth
Birth weight
APGAR 1 mn

APGAR 5 mn
APGAR 10 mn
Umbilical pH
Umbilical PaCO2
Umbilical lactate value
Umbilical base excess
Post delivery lowest SpO2
O2 requirement after delivery
If mechanical ventilation: FiO2%
If no mechanical ventilation: O2 L/mn
Blood gases measurement: Yes/no
Maternal arterial pH
Maternal arterial PaO2
Maternal arterial PaCO2
Maternal arterial lactate
Maternal arterial HCO3
Non-invasive ventilation requirement within 6 first hours after delivery
High-flow oxygen therapy requirement within the first 6 h after delivery
Tracheal Intubation needed within 6 h after delivery
Place of hospital stay after delivery
Duration of mechanical ventilation
Complication: need for reoperation
Day of reoperation
Complication: postoperative site Infection
Complication: transfusion
Complication: transfusion (day)
Complication: pneumonia
Complication: pneumonia (day)
Complication: acute kidney injury
Death in hospital
Day of death
Hospital discharge
Day of hospital discharge

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