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Retrospective Study

# COVID-19 Pneumonia in Pregnancy: A Retrospective Study on Maternal and Neonatal Outcomes

**Benlghazi Abdelhamid[1]*, Belouad Moad[1], Hanane Dabdi[2], Bouhtouri Yassine[1], Messaoudi Hamza[1], Benali Saad[1], Ait Bouhou Rachid[1], El Mangoub Fatima[1], Elhassani Mly El Mehdi[1] and Kouach Jaouad[1]**

[1]Department of Gynecology and Obstetrics, Military Hospital Mohammed V Rabat, Faculty of Medicine and Pharmacy of Rabat, University Mohammed V Rabat, Morocco

[2]National Centre for Reproductive Health Rabat, Faculty of Medicine and Pharmacy of Rabat, University Mohammed V Rabat, Morocco

## Abstract

**Objective:** To identify risk factors among pregnant with COVID-19 for adverse outcomes related to disease severity, maternal mortality, and morbidity.

**Materials and methods:** In this retrospective study, 45 pregnant patients with COVID-19 pneumonia were confirmed by RT-PCR. The inclusion criteria were pregnant patients diagnosed with COVID-19 confirmed by RT-PCR and hospitalized in the gynecology-obstetrics and intensive care unit. Exclusion criteria were non-pregnant patients and pneumonia cases with unconfirmed COVID-19 causes. The study used SPSS software to analyze the data.

**Results:** Our study recorded 45 cases of SARS-CoV-2 infection in pregnant women over 2.5 years. The age group most affected was 20-35 years, with 75% of cases. 57% of patients had no known comorbidities. 88.8% of patients were symptomatic at diagnosis. Almost 30% of patients required admission to the ICU, with 60% requiring oxygen supplementation. The study recorded 36 live births (80%), of which 26 cases (72.2%) required no further care and had a favorable outcome.

**Conclusion:** Pregnant women with medical conditions are at higher risk of severe COVID-19, which can cause respiratory distress syndrome and impact delivery and neonatal outcomes. Preventive measures are important.

**More Information**

***Address for correspondence:**
Benlghazi Abdelhamid, Department of Gynecology and Obstetrics Military Hospital Mohammed V Rabat, Faculty of Medicine and Pharmacy of Rabat, University Mohammed V Rabat, Morocco,
Email: benlghaziabdelhamid333@gmail.com

https://orcid.org/0000-0002-0728-7409

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**Keywords:** COVID-19; Maternal mortality; Neonatal mortality; Pneumonia; Pregnancy; Preterm birth; SARS-CoV-2



## Introduction

Since December 2019, cases of pneumonia have been reported in Wuhan, China. The number of cases increased rapidly in January 2020, leading the WHO to declare a public health emergency of international concern. In March 2020, due to the international spread and severity of the cases, the WHO identified the situation as a COVID-19 pandemic [1].

Confirmed cases of COVID-19 vary clinically, from asymptomatic to severe. Pregnancy has been classified as a risk factor predisposing to critical forms of the disease [2].

Since the beginning of the pandemic, considerable effort has been devoted to the subject, to bring out the epidemiological and clinical data on maternal-fetal evolution, as well as the protocols adapted to the different forms of the disease in this category of patients. This study aims to clarify the association between COVID-19 and pregnancy through a series of 45 cases recorded in our gynecology-obstetrics department and to review the literature on the subject [3].

## Materials and methods

We conducted a retrospective descriptive and analytical study of 45 patients who were registered in the gynecology-obstetrics department between April 1, 2020, and August 1, 2022. These pregnant patients were managed for COVID-19 pneumonia confirmed by real-time polymerase chain reaction (RT-PCR). The data to be analyzed were recorded on a data sheet, and we identified 45 files that met our inclusion criteria. For some patients, we made telephone calls to obtain the remaining information.

The inclusion criteria for our study were pregnant patients who had been diagnosed with COVID-19 infection confirmed by RT-PCR on nasopharyngeal swab samples and were hospitalized in the gynecology-obstetrics and intensive care unit. We only included cases that met these criteria in our evaluation form, which was filled in for each case while ensuring anonymity and encryption of the data.

Our exclusion criteria were non-pregnant patients and pneumonia cases with COVID-19 causes not confirmed by RT-PCR test. After collecting all the data, we processed it using SPSS V29 software and analyzed it using headcounts and percentages. This allowed us to draw meaningful conclusions from the data and better understand the impact of COVID-19 on pregnant patients.

## Results

Our study recorded 45 cases of SARS-CoV-2 infection in pregnant women over 2.5 years in the gynecology-obstetrics department. The average age of the patients was 36, and the age group most affected was 20-35 years, accounting for 75% of cases. In terms of comorbidities, 57% of patients had no known comorbidities, 9,76% ($n$ = 4) had pregestational diabetes, and 11% had obesity. Gestational age at the time of COVID-19 infection was over 28 SA in 35 cases, accounting for 78%, 9 cases were between 28 and 14 SA, accounting for 20%, and only one case was less than 14 SA. Moreover, out of the total number of patients ($n$ = 17), 37% had been vaccinated against COVID-19. Among the vaccinated cases, 7 individuals received the AstraZeneca vaccine, while 10 received the Sinopharm vaccine (Table 1).

In terms of clinical symptoms, 88.8% of patients were symptomatic at the time of diagnosis, with general symptoms including fever (55.5%), asthenia (49%), headache (35.5%), myalgia (35.5%), anosmia (28%), and ageusia (12%). Cough was present in 40% of patients, sore throat in 13%, and dyspnea in 8.85%. On admission, vital signs were assessed for all patients, and hemodynamically, all patients had a correct mean arterial pressure, although tachycardia was noted in 12%. Respiratory dyspnea with desaturation to room air (Saturation < 93%) was noted in 17.5%. The Glasgow score was 15/15 in all patients (Table 2) [4].

Paraclinical findings from our study revealed that 15.6% of cases exhibited hyperleukocytosis (WBC > 15000 cells/µL), anemia was detected in 15% of cases, whereas lymphopenia and thrombocytopenia in two cases each. CRP was positive (> 10 mg/L) in 36% of patients, and LDH > 250 IU/l was noted in 22% of cases. Additionally, creatine kinase levels greater than 170 IU/l were detected in 4.5% of cases, and ferritin levels greater than 120 mg/l in 6.7% of cases.

All patients with signs of clinical or biological severity underwent a thoracic CT scan, with eight patients receiving this evaluation. Of those, two patients were classified as Corads 2, two as Corads 3, one as Corads 4, and three as Corads 5.

In terms of management and evolution, the study found that almost 30% of patients required admission to the intensive care unit, with 60% requiring oxygen supplementation. Of those patients, 49% received oxygen via high-concentration mask, 7% via non-invasive ventilation, and 4% via invasive ventilation. It should be noted that 20% of admissions to the intensive care unit were suffering from co-morbidity (obesity $n$ = 2, pre-gestational diabetes = 4, pulmonary pathology $n$ = 4).

Azithromycin was used as a preventive antibiotic therapy in 65% of cases, while other antibiotics were prescribed in the event of signs of bacterial infections, including amoxicillin-clavulanic acid (20%), ceftriaxone (13%), and tavanic (2.2%).

Low-molecular-weight heparin was used as

**Table 1:** Table showing patient distribution according to comorbidity.

| | Our series ($n$ = 45) | Smith, et al. ($n$ = 926) [13] |
|---|---|---|
| Age Median—y.o. (IQR) | 30 (27-37) | 32 (28–36) |
| **Age range** | | |
| Age < 20 | 7% ($n$ = 3) | |
| Age 20-35 | 18% ($n$ = 8) | 29.4 % ($n$ = 272) |
| Age > 35 | 75% ($n$ = 34) | |
| **Gestational age (%)** | | |
| < 20 Weeks of amenorrhea | 22,2% ($n$ = 10) | 9.6% ($n$ = 89) |
| > 20 Weeks of amenorrhea | 77,78% ($n$ = 35) | 89.2% ($n$ = 826) |
| **Comorbidity (%)** | | |
| High blood pressure | 0% ($n$ = 0) | 2.1% ($n$ = 19) |
| Pulmonary comorbidities | 9,76% ($n$ = 4) | 3.8% ($n$ = 35) |
| Pregestational diabetes | 9,76% ($n$ = 4) | 1.3% ($n$ = 12) |
| Thyroid dysfunction | 4,88% ($n$ = 2) | 3.7 ($n$ = 4) |
| Other ( (neurological, urological, digestive, orthopedic) | 4,88% ($n$ = 2) | 9.2% ($n$ = 85) |
| **Obésité** | | |
| BMI > 30 | 4,88% ($n$ = 2) | 31,3% ($n$ = 289) |
| No comorbidity | 70,7% ($n$ = 33) | 68,7% ($n$ = 637) |

**Table 2:** Table showing the distribution of cases according to symptoms at presentation.

| | Our series ($n$ = 45) | Mullins, et al. ($n$ = 8239) [12] | Smith, et al. ($n$ = 926) [13] |
|---|---|---|---|
| **Distribution of cases** | | | |
| Asymptomatic | 12% ($n$ = 5) | 23,3% ($n$ = 1804) | 31.9% ($n$ = 295) |
| Symptomatic | 88% ($n$ = 40) | 76,7% ($n$ = 5943) | 68,1% ($n$ = 631) |
| **General signs** | | | |
| Fever | 55,5% ($n$ = 25) | 39% ($n$ = 3018) | 32,4% ($n$ = 300) |
| Headache | 8,8% ($n$ = 4) | No data | 13,1% ($n$ = 121) |
| Myalgia | 35,5% ($n$ = 16) | 21,1% ($n$ = 1637) | 16,0% ($n$ = 148) |
| Fatigue | 48,6% ($n$ = 22) | 34% ($n$ = 2637) | 20,6% ($n$ = 191) |
| **Respiratory signs** | | | |
| dyspnea | 8,8% ($n$ = 4) | 27,2% ($n$ = 2110) | 15,8% ($n$ = 146) |
| Chest pain | 0% ($n$ = 0) | 9,5% ($n$ = 737) | No data |
| Cough | 40% ($n$ = 18) | 45,4% ($n$ = 3514) | 40,4% ($n$ = 374) |
| **Oto Rhino Laryngeal signs** | | | |
| Sore throat | 13,3% ($n$ = 6) | 7,7% ($n$ = 598) | 9,0% ($n$ = 83) |
| Anosmie and /or Agueusie | 42,1% ($n$ = 19) | 27,2% ($n$ = 2233) | 17,8% ($n$ = 165) |
| **Digestive signs** | | | |
| Pas signe digestif | 87% ($n$ = 39) | 77,2% ($n$ = 5982) | |
| Diarrhée | 6,66% ($n$ = 3) | 5,5% ($n$ = 429) | No data |
| Nausea/vomiting | 6,66% ($n$ = 3) | No data | 5.2% ($n$ = 48) |
| Anorexie | 6,66% ($n$ = 3) | 13,3% ($n$ = 1030) | No data |

anticoagulation therapy in 51.2% of patients in a preventive dose and 15.5% in a curative dose, while 33.3% did not receive anticoagulation. Curative dose was used in 15 patients suffering from pulmonary embolism ($n$ = 4) and deep venous thrombosis ($n$ = 3). The study found that 43 patients had a favorable outcome, but unfortunately, two deaths were noted, the first death was caused by a massive pulmonary artery embolism, and the second by severe respiratory distress complicated by cardiorespiratory arrest. Additionally, two cases did not result in delivery, one due to abortion and the other due to maternal death before delivery. Of the deliveries, 20 were Caesarean sections, and 23 were vaginal deliveries. Over 50% of Caesarean sections were performed due to acute fetal distress.

Regarding pregnancy outcomes, the study recorded 36 live births (80%), of which 26 cases (72.2%) required no further care and had a favorable outcome. Ten cases (27.7%) were hospitalized in a neonatal unit but also had a favorable outcome. Unfortunately, there were six cases (13.3%) of fetal death in utero (FIDU), one case of fetal death following maternal death, one case of death in a premature newborn, and one case of early abortion.

Low weight for gestational age was noted in almost 25% of cases (Table 3).

**Table 3:** Key perinatal outcomes and literature review.

| Outcomes | Our series ($n$ = 45) | Mullins, et al. ($n$ = 8239) [12] | Smith, et al. ($n$ = 926) [13] |
|---|---|---|---|
| No adverse outcomes | 71,11% ($n$ = 32) | No data | 89.4% ($n$ = 828) |
| Severe adverse outcomes | 28,8% ($n$ = 13) | No data | 9.9% ($n$ = 92) |
| Admission to ICU | 28,8% ($n$ = 13) | No data | 4.0% ($n$ = 37) |
| Advanced oxygen support | 11,11% ($n$ = 5) | 2,2% ($n$ = 176) | 7,3% ($n$ = 68) |
| Maternal death | 4,44% ($n$ = 2) | 14/8197 (0.2%) | 0.6% ($n$ = 6) |
| Early neonatal death | 2,75% ($n$ = 1) | 11/8050 (0.1%) | 0.2% ($n$ = 1) |
| Pre-eclmapsia | 2,22% ($n$ = 1) | 389/8189 (4.8%) | No data |
| Eclampsia | 0 | 41/8192 (0.5%) | No data |
| **Pregnancy outcomes** | | | |
| Liveborn | 80% ($n$ = 36) | 8066 (98.5%) | 97,46% ($n$ = 731) |
| Miscarriage | 2,22% ($n$ = 1) | 82 (1.0%) | |
| Fetal loss | 13,3% ($n$ = 13) Fetal loss > 14 WG | 35 (0.4%) Intra-uterine death (>22 + 6 weeks Gestation) | 2,45% ($n$ = 19) Fetal loss > 14 WG |
| **Mode of delivery (all births)** | | | |
| Vaginal | 53,48% ($n$ = 23) | 58,2% ($n$ = 4753) | 64,68% ($n$ = 469) |
| Cesarean section | 46,51% ($n$ = 20) | 41,7% ($n$ = 3404) | 35,3% ($n$ = 256) |
| **All indicated deliveries** | | | |
| Maternal hypoxia | 5% ($n$ = 3) | 3,2% ($n$ = 115) | No data |
| Fetal compromise | 55% ($n$ = 10) | 23,9% ($n$ = 871) | No data |
| Other | 40% ($n$ = 7) | 73,0% ($n$ = 2664) | No data |
| **Birthweight and fetal growth restriction in participants.** | | | |
| < 10 percentile | 26% ($n$ = 11) | 9,3% ($n$ = 744) | 4,35% ($n$ = 40) |
| 10-91 percentil | 68% ($n$ = 29) | 83,9% ($n$ = 6686) | No data |
| > 91 percentil | 6% ($n$ = 3) | 6,8% ($n$ = 546) | No data |
| **Neonatal outcomes: NICU admission** | | | |
| Respiratory distress syndrome | 12,5% ($n$ = 5) | 4.6% ($n$ = 374) | 4,4% ($n$ = 33) |
| Prematurity | 10% ($n$ = 4) | 11,5% ($n$ = 922) | 7,2% ($n$ = 54) |

## Discussion

The COVID-19 pandemic has created an unprecedented global health crisis, with the rapid spread of the infection and the uncertainty surrounding its impact on pregnancy due to the lack of scientific data. Obstetricians have had to adapt their practices based on pragmatic approaches in response to this challenging situation [1].

Pregnancy triggers physiological changes that primarily affect the cardiorespiratory and immune systems. These changes include Th2 immunotolerance and alterations in the major histocompatibility complex expression at the maternal-fetal interface, making pregnant women more vulnerable to viral infections such as influenza or SARS-CoV-2 [2].

Pregnant women are at a heightened risk of developing respiratory pathologies and severe pneumonia due to their immunosuppressed state and adaptive physiological changes during pregnancy. These changes can make them more intolerant to hypoxia, putting them at higher risk during pandemics and other respiratory outbreaks.

Historical evidence, such as the influenza pandemic of 1918, highlights the increased vulnerability of pregnant women during pandemics. During that pandemic, pregnant women had a mortality rate of 2-6%, compared to the general population. Similarly, during the H1N1 2009 pandemic influenza virus outbreak, pregnant women faced a relative risk of 3-4 for complications from infection and were more than four times as likely as the general population to be admitted to the hospital [5].

A multicenter study conducted in France since the start of the COVID-19 pandemic examined data from 33 maternity clinics and found that 617 pregnant women tested positive for SARS-CoV-2, with the most commonly reported symptoms being cough (62.2%), fever (46.2%), anosmia (27.2%), dyspnea (26.7%), and diarrhea (8.8%). Of the pregnant women, 20.7% required respiratory assistance, with 4.7% requiring mechanical ventilation, 1% needing extracorporeal membrane oxygenation (ECMO), and 0.2% died. Risk factors for needing respiratory assistance included age over 35, high pre-pregnancy body mass index (> 30 kg/m$^2$), pre-existing diabetes or a history of pre-eclampsia, and a current diagnosis of gestational hypertension or pre-eclampsia. These risk factors are similar to those found in the general population.

A meta-analysis published in September 2020 that included 77 studies found that pregnant women with COVID-19 had a 40% incidence of fever and a 39% incidence of cough. They were more likely to require intensive care unit admission and invasive ventilation. The analysis found 73 deaths (0.1%). Risk factors for severe disease included age, high body mass index, chronic hypertension, and diabetes. Women with pre-existing comorbidities had a higher risk of ICU admission (OR = 4.21) [3,6].

In a case-control study comparing data from 8,207 pregnant women and 83,205 non-pregnant women with confirmed SARS-CoV-2 infection, it was found that pregnant women had a higher risk of intensive care hospitalization (RR 1.2) and mechanical ventilation (RR 1.9) compared to their non-pregnant counterparts. However, there was no significant difference in mortality risk between pregnant and non-pregnant women with the virus.

Various biological abnormalities have been observed in individuals with COVID-19, as per the existing literature. One such abnormality is lymphopenia, which can be identified in patients as early as the viral disease phase. During the first week of illness, elevated levels of transaminases may also be observed. In the second week, which is considered the inflammatory response phase, markers such as CRP, procalcitonin, and ferritin may increase [7].

Special attention is required in managing pregnant women with COVID-19, considering the potential impact of pregnancy on the respiratory and cardiovascular systems. Close monitoring is particularly crucial during the first two weeks of the disease's evolution, as rapid deterioration can occur during this period.

Hospitalization of pregnant women with confirmed or suspected COVID-19 is not always required, except in cases where there is a need for oxygen support. In situations where symptoms are not severe, ambulatory management with symptomatic treatment is generally advised. However, it is crucial to educate the woman about the symptoms that require medical reassessment, such as fever, cough, and dyspnea. Self-medication should be avoided.

Hospitalization is necessary in cases where severe symptoms develop rapidly, such as a respiratory rate of 25 cycles per minute or higher and oxygen saturation levels of less than 95% in ambient air. Management in the hospital may involve a thoracic CT scan, oxygen therapy, invasive ventilation, and corticosteroid therapy to reduce inflammation when C-reactive protein (CRP) levels are greater than 50 [2].

Oxygen therapy is initiated based on respiratory rate and saturation levels. The threshold for initiating oxygen therapy is when SpO2 falls below 95%.

According to the latest recommendations, antibiotic therapy is not recommended for COVID-19 unless there is a documented co-infection [7].

SARS-CoV-2 infection increases the risk of thrombosis in patients, and therefore, it is crucial to systematically assess the thrombotic risk in all patients with confirmed infection. The completion of ongoing studies, including the FREEDOM COVID-19 trial, is necessary to determine if therapeutic-dose anticoagulation provides additional efficacy in reducing thrombotic events, preventing intubation, or improving survival compared to prophylactic-dose anticoagulation in hospitalized patients [8,9].

Vitamin D supplementation may be beneficial for COVID-19 patients with vitamin D deficiency or insufficiency, but there is no evidence to support its use in the prevention or reduction of disease severity in individuals with normal blood vitamin D levels [10]. Beigmohammadi et al. found that vitamin supplementation led to significant changes in serum levels of various vitamins and inflammatory markers, and reduced the rate of hospitalization lasting more than 7 days, but did not have a significant effect on mortality [11,12].

According to the PAN-COVID study, which is an international multicenter study conducted in 43 centers across 18 different countries to evaluate the pregnancy and neonatal outcomes of women with COVID-19. The study found that infection during pregnancy is associated with preterm birth, primarily due to fetal distress. Although the incidence of small for gestational age and fetal growth restriction was not higher than expected, there was a significant difference in the proportion of participants affected by stillbirth and FGR, depending on whether they delivered within two weeks or after. To address this, clinicians should have a low threshold for delivery if they detect concerns with fetal movements or heart rate monitoring during this period.

The study also found that SARS-CoV-2 infection during pregnancy does not seem to affect birth weight or increase the risk of congenital malformations. However, the effect of infection on miscarriage was not determined. The rate of pre-eclampsia among the study participants was not higher than expected, and neonatal infection was uncommon [13].

### Limitations of study

The retrospective study of risk factors in pregnant women with COVID-19 has several limitations. These include a small sample size, a selection bias in favor of hospitalized cases, and the absence of a control group. These limitations may affect the generalisability of the results. Future research involving larger sample sizes and prospective models will provide a better understanding of the risk factors associated with COVID-19 in pregnant women and their maternal-fetal impact.

## Conclusion

Even though pregnant women are already recognized as a high-risk group by the WHO and should have equal access to safe and effective preventive and therapeutic measures, pregnant women with additional risk factors require special attention. Evidence suggests that advanced maternal age and high body mass index are associated with a greater risk of severe COVID-19 in pregnant women. Furthermore, pregnant women with COVID-19 have been found to have higher rates of preterm birth compared to those without the disease. Therefore, it is crucial that healthcare providers closely monitor pregnant women with these risk factors and provide appropriate care to mitigate the risk of adverse outcomes.

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### Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

### Ethics approval statement

All authors declare that all stages of the study were carried out in accordance with the relevant laws and institutional guidelines and the ethical standards of the Declaration of Helsinki.

### Declaration of patient consent

Informed consent was obtained from each patient enrolled in the clinical study.

### Author contributions

Benlghazi Abdelhamid, Hanane Dabdi and Kouach Jaouad performed conceptualization and supervision of the study. Benlghazi Abdelhamid and Hanane Dabdi arranged funding acquisition. Benlghazi Abdelhamid ,Hanane Dabdi and Kouach Jaouad developed methodology and investigation. Benlghazi Abdelhamid ,Hanane Dabdi and Kouach Jaouad involved in project administration. Benlghazi Abdelhamid ,Belouad Moad ,Hanane Dabdi and Kouach Jaouad provided resources. Benlghazi Abdelhamid ,Hanane Dabdi and Kouach Jaouad performed data curation and analysis. All authors prepared visualization, writing original draft, review and editing.

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