Coronavirus disease 2019 (COVID-19) arises from infection with the new severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The susceptible population can be of any age and gender; thus, the disease threatens the health and life of everyone, including pregnant women. Pregnancy can influence the physiological function of various organs, and thus may affect the prognosis of many infectious diseases. For example, higher mortality rates and more complications were reported in pregnant patients infected with SARS-CoV than those in non-pregnant patients.2

Clinical manifestations and treatment monitoring of pregnant women with COVID-19 have been reported in previous studies, which mainly focus on maternal and pregnant women with COVID-19 have been reported in Clinical manifestations and treatment monitoring of coronavirus 2 (SARS-CoV-2). The susceptible population with the new severe acute respiratory syndrome into the continued pregnancy group and “terminated pregnancy group” according to whether the patient terminated the pregnancy during hospitalization. The Ethics Committee of Tongji Hospital approved this study (No. TJ-IRB2020401), and the requirement for informed consent was waived.

We obtained and reviewed demographics, medical history, pre-admission information, symptoms at disease onset, laboratory findings at admission, chest computed tomographic (CT) scans, quantitative real-time reverse transcription-polymerase chain reaction (RT-PCR) assay results for SARS-CoV-2, treatments, complications, and prognosis for participants. Particularly, laboratory findings within 7 days after the termination of pregnancy were compared with laboratory findings at admission. According to the New Coronavirus Pneumonia Prevention and Control Program (5th edition), we included both laboratories diagnosed cases and clinically diagnosed cases to present the complete spectrum of COVID-19 and defined the severity of COVID-19 and hospital discharge standards. Criteria involving previous medical history were defined as follow: (1) chronic lung diseases included chronic obstructive pulmonary disease, asthma, and tuberculosis; (2) chronic kidney diseases included glomerulonephritis, pyelonephritis, and nephrotic syndrome; and (3) chronic liver diseases included hepatitis, liver cirrhosis, and fatty liver disease. Possible complications of these participants were recorded and analyzed. Abnormal liver function was defined as alanine aminotransferase >66 U/L, with or without total bilirubin >21 μmol/L. Abnormal renal function was defined as blood creatinine >84 μmol/L, or the concentration of blood urea nitrogen >7.5 mmol/L.

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Heart function injury was defined as hypersensitive cardiac troponin >15.6 pg/mL or N-terminal pro-brain natriuretic peptide >116 pg/mL. Digestive system injury was defined as developing severe symptoms of the digestive tract, such as nausea, vomiting, abdominal pain and diarrhea, and abnormal stool. Respiratory system injury was defined as having cough, sputum production, or hypoxia symptoms and the requirement for assisted ventilation treatment, including oxygen support, tracheal intubation and being on a ventilator. Nervous system injury was defined as developing relative symptoms, such as seizures, coma or drowsiness.

We performed statistical analyses using SPSS version 26.0 (SPSS Inc., Chicago, IL, USA). Continuous variables were described as medians (Q1, Q3) when abnormally distributed, and categorical variables were described as numbers (percentages). We compared continuous variables using Mann–Whitney U test or a paired-sample Wilcoxon signed-rank test, and compared categorical variables using $\chi^2$ test or Fisher exact test. A value of $P < 0.05$ was considered statistically significant.

From January 19 to April 1, 2020, a total of 285 women of childbearing age with COVID-19 were admitted to our hospital, including 30 pregnant women and 255 non-pregnant women. The median ages of pregnant and non-pregnant women were 31 (30, 34) years and 36 (31, 41) years ($Z = -3.600, P < 0.001$), respectively. Fever, cough, and sputum production were the most common initial symptoms. In addition, seven pregnant women (23.3%) presented with diarrhea at disease onset, while 30 non-pregnant women (11.8%) presented with diarrhea ($\chi^2 = 3.180, P = 0.075$) [Supplementary Table 1, http://links.lww.com/CM9/A469].

In laboratory findings, pregnant patients showed special characteristics. The pregnancy group had a higher leukocyte count (8.72 [5.96, 10.12] $\times 10^9$/L vs. 5.36 [4.02, 6.97] $\times 10^9$/L, $Z = -5.106, P < 0.001$), a higher neutrophil percentage (77.55 [70.63, 83.23]% vs. 58.90 [51.85, 68.20]%, $Z = -6.328, P < 0.001$), and lower percentages of lymphocytes (15.50 [12.50, 21.90]% vs. 29.60 [22.05, 36.50]%, $Z = -5.820, P < 0.001$) and monocytes (6.15 [4.65, 7.33]% vs. 8.10 [6.60, 9.80]%, $Z = -4.258, P < 0.001$) compared with the non-pregnancy group. Moreover, the pregnancy group also presented with higher levels of D-dimer (1.31 [0.65, 1.95] mg/mL, $Z = 2.396, P = 0.017$), erythrocyte sedimentation rate (29.00 [21.00, 43.00] mm/1 h, $Z = 2.689, P = 0.007$) and interleukin-6 (14.50 [3.56, 39.75] pg/mL vs. 4.46 [2.34, 12.98] pg/mL, $Z = -2.396, P = 0.017$) than the non-pregnancy group [Supplementary Table 2, http://links.lww.com/CM9/A469].

As shown in Table 1, the pregnancy group presented a lower percentage of respiratory system injury (76.7% vs. 92.5%, $\chi^2 = 8.167, P = 0.004$), a lower rate of antiviral therapy (70.0% vs. 86.7%, $\chi^2 = 5.820 P = 0.016$) and a higher rate of oxygen support (86.7% vs. 67.1%, $\chi^2 = 4.835, P = 0.028$) compared with the non-pregnancy group. Furthermore, no patient in the pregnancy group died in our study, but there were seven dead cases in the...
non-pregnancy group. The median symptom-to-discharge duration of the pregnancy group was significantly shorter than that of the non-pregnancy group (24 [18, 38] days vs. 31 [23, 42] days, Z = −2.143, P = 0.032).

We compared complications, hospital stay and prognosis between the continued pregnancy group (n = 8) and the terminated pregnancy group (n = 22). The results show that the complications in the continued pregnancy group did not increase compared with the terminated pregnancy group (all P > 0.05). The median duration of symptom-to-discharge in two groups were 23 [18, 42] days and 24 (18, 37) days (Z = −0.250, P = 0.803), respectively [Supplementary Table 3, http://links.lww.com/CM9/A469]. Furthermore, mild differences were detected in the laboratory characteristics between the two groups. The percentage of lymphocytes increased after the termination of pregnancy (16.40 [12.00, 22.45]% vs. 20.80 [15.65, 28.05]%), Z = −2.352, P = 0.019, while the percentage of neutrophils (77.40 [69.80, 83.45]% vs. 68.90 [62.55, 80.00]%), Z = −2.073, P = 0.038) and the high-sensitivity C-reactive protein level (16.65 [2.7, 36.35] mg/L vs. 13.1 [1.9, 20.6] mg/L, Z = −2.198, P = 0.028) both decreased after the termination of pregnancy.

The epidemic of COVID-19 is spreading rapidly and has become a global health emergency. There are two main issues for pregnant patients that arouse public concern: the first is whether COVID-19 infection during pregnancy can affect the prognosis of pregnancy, the other is whether the pregnancy process would exaggerate the viral infection, and thus, lead to poor prognosis. In this retrospective single-center cohort study, there were a total of 285 women of childbearing age infected with SARS-CoV-2; 10.5% (30 cases) of them were pregnant patients. We find that pregnant and non-pregnant women with COVID-19 have similar epidemiological characteristics. However, pregnant patients seemed to have relatively mild clinical manifestations, specific laboratory characteristics, fewer deaths, and a shorter symptom-to-discharge duration.

Of the clinical characteristics of childbearing-aged women with COVID-19, fever, cough, and sputum production were the most common initial symptoms in both the pregnancy and non-pregnancy groups; diarrhea may also be a common clinical manifestation in pregnant women with COVID-19. The laboratory results of pregnant women with COVID-19 showed special characteristics, including a higher leukocyte count, a higher neutrophil percentage, and higher levels of D-dimer, high-sensitivity C-reactive protein, and erythrocyte sedimentation rate. These findings may be explained by the special physiological and immunological state during pregnancy rather than bacterial co-infection, because these pregnant patients did not present other clinical manifestations associated with bacterial co-infection. Until now, there is no specific intervention recommended by reliable evidence for pregnant patients. Therefore, pregnant women with COVID-19 received similar treatments compared with non-pregnant patients. In our study, seven patients died in the non-pregnancy group, while the pregnancy group had no deaths.

Comparison between the continued pregnancy group and the terminated pregnancy group showed that the complications and prognosis between the two groups were not significantly different. These results suggest that terminating a pregnancy or not did not affect the prognosis of COVID-19. To further confirm the above conclusions, we analyzed changes in laboratory indicators before and after termination of pregnancy. Soon after the termination of pregnancy, some indicators associated with the physiological characteristics and immune status of pregnancy (eg, neutrophils and high-sensitivity C-reactive protein) can quickly return to the non-pregnant state, which also indicates that the effect of pregnancy on COVID-19 is reversible.

In conclusion, pregnant and non-pregnant women with COVID-19 infection had similar epidemiological characteristics, but pregnant patients presented relatively mild clinical manifestations, shorter symptom-to-discharge duration, and pregnancy-related specific laboratory examination characteristics. More data are still needed for a better in-depth understanding of these characteristics of COVID-19 infection during pregnancy, and further studies are warranted to determine the specific mechanisms behind these traits.

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**Conflicts of interest**

None.

**References**

1. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet 2020;395:507–513. doi: 10.1016/s0140-6736(20)30211-7.
2. Peiris JS, Yuen KY, Osterhaus AD, Stöhr K. The severe acute respiratory syndrome. N Engl J Med 2003;349:2431–2441. doi: 10.1056/NEJMra032498.
3. Yu N, Li W, Kang Q, Xiong Z, Wang S, Lin X, et al. Clinical features and obstetric and neonatal outcomes of pregnant patients with COVID-19 in Wuhan, China: a retrospective, single-centre, descriptive study. Lancet Infect Dis 2020;20:539–564. doi: 10.1016/s1473-3099(20)30176-6.
4. New coronavirus pneumonia prevention and control program (5th ed) (in Chinese). Beijing: National Health Commission of the People's Republic of China, 2020. Available from: http://www.nhc.gov.cn/xcs/zhengcxwj/202002/24b8953537c19944508d728ca1e3ce13a/files/a66bcc7f3664c7f998f80299120d6.pdf. [Accessed February 8, 2020].
5. Wang JW, Cao B, Wang C. Science in the fight against the novel coronavirus disease 2019 (COVID-19). Chin Med J 2020;133:1009–1011. doi: 10.1097/cm9.0000000000000777.

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