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Journal of Infection

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## Letter to the Editor

**Recurrent PCR positivity after hospital discharge of people with coronavirus disease 2019 (COVID-19)**

Dear Editor,

The outbreak of coronavirus disease 2019 (COVID-19) was reported by Tang and colleagues in late December 2019 in Wuhan, China, in this journal, with a series of respiratory infected by a novel coronavirus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).<sup>1</sup> By March 3, 2020, 105,586 cases of COVID-19 pneumonia were laboratory-confirmed in over 100 countries worldwide.<sup>2</sup> Infection caused by SARS-CoV-2 can result in acute respiratory distress syndrome (ARDS), which is similar to the symptoms induced by the Middle East respiratory syndrome coronavirus.<sup>3,4</sup> With deeper understanding of the biological characteristic of SARS-CoV-2, great successful progress has been made in COVID-19 treatment. A total of 79,251 confirmed cases were reported in China by February 28, and 39,002 cases out of them have been cured and discharged from hospitals.<sup>5</sup>

During January 28 to March 13, 6 COVID-19 recurrence cases were found in Shangqiu, Henan Province, China (Fig. 1). Among the recurrence cases, one case (Case 1) had significant post-discharge clinical symptoms and discomfort for nine days, one case (Case 3) had a mild cough, and 4 cases (Case 2, 4, 5, and 6) were asymptomatic with positive RT-PCR nucleic acid test.

Case 1, a 35-year old female living in Shangqiu, worked as a hairdresser, and her contact history with Wuhan-imported cases was not excluded. This patient experienced her first symptoms including fever (max temperature: 38.5 °C), cough, and expectoration (white sticky sputum) for 9 days before the first admission (February 1, 2020). After the SARS-CoV-2 test of RT-PCR assay was reported positive by CDC of Shangqiu City, on January 30, 2020, the patient was isolated for treatment in the hospital and was discharged on February 17, 2020, after a 16-day treatment, and received a 14-day quarantine at home. No contact history with other confirmed or possible COVID-19 patients was reviewed during the quarantine period. However, this female experienced repeated fatigue, expectoration, sore muscles, and nausea once again, with body temperature fluctuating in 36.5 ~ 36.8 °C. Once again, the SARS-CoV-2 RT-PCR nucleic acid test was reported positive on February 26, 2020, and this woman was rehospitalized on February 28, 2020 (Fig. 1).

Case 2, a 56-year-old female travelling from Wuhan, arrived in Shangqiu on January 18, 2020, and was suffering from irregular fever, cough, expectoration, fatigue, and muscle soreness until January 25, 2020. This woman was laboratory confirmed as a COVID-19 patient on January 30, 2020 and received a 12-day treatment during February 1 ~ 13, 2020. After that, this patient was dis-

charged according to the criterion, including significantly improved manifestations in clinic and CT imaging, and two negative nucleic acid testing with an interval of 24 hours. During subsequent isolation at home, the patient did not experience any symptoms or discomfort or contact history, however, the recurrence of a positive nucleic acid test was reported on February 28, 2020. This patient was readmitted to the hospital for another treatment on the same day. Case 2 also had a previous history of hypertension for 3 years (Fig. 1).

The median age of recurrence cases was 45.2 years (varying from 30 ~ 56 years old) and all were female. Two cases had previous history, one with hypertension, and one with chronic bronchitis. All patients had no history of smoking. Of the 6 cases, one experienced significant symptoms during the relapse, one had occasional cough, and four cases were asymptomatic. Most frequent symptoms at their first admission were fever, cough, and expectoration.

Recurrence cases showed no significant difference ( $P>0.05$ ) with control cases in leukocyte, lymphocyte, neutrophil, platelet, and albumin counts (Table. 1). Most demonstrated lower albumin and abnormal coagulation indexes. The first admission showed abnormal coagulation function in five cases: 3 cases with higher blood platelet count (one was consistently above normal), 2 cases with prolonged prothrombin time, and one case with a transient D-dimer elevation (1319). At the second admission, 4 cases presented normal indexes of coagulation function while case 2 showed an elevated index of whole blood D-dimer (1033.46 ug/mL). Chest CT scanning was performed every 3~4 days on average from the initial examination, and each case involved at least 5 CT scans. CT manifestations of the 6 cases were characterized with patch-like ground-glass opacities (GGO) in bilateral lungs, and tend to have a gradually improved trend from admission to discharge, to relapse. Multiple antiviral treatments were applied, including recombinant human interferon  $\alpha$  -1b / 2b antiviral therapy (5 million U, b.i.d., nebulization), oral lopinavir/ritonavir (100 mg, b.i.d., p.o.), and abidol (200 mg, t.i.d., p.o.), combined with traditional Chinese medicine treatments. Methylprednisolone was intravenously used in one case, for 1 day (40 mg, b.i.d.) during the first hospitalization.

Because the infectious period of COVID-19 infection was not completely clear and several recurrence cases occurred, we suggest that further consecutive observation and supervision for at least two weeks were needed for the people discharged from hospital. In addition, we may also combine other methods to detect this virus, such as the serologic examination of SARS-CoV-2-specific IgM antibody. Further, personalized treatment should be adopted in order to cure patients completely, thereby reducing the recurrence rate.

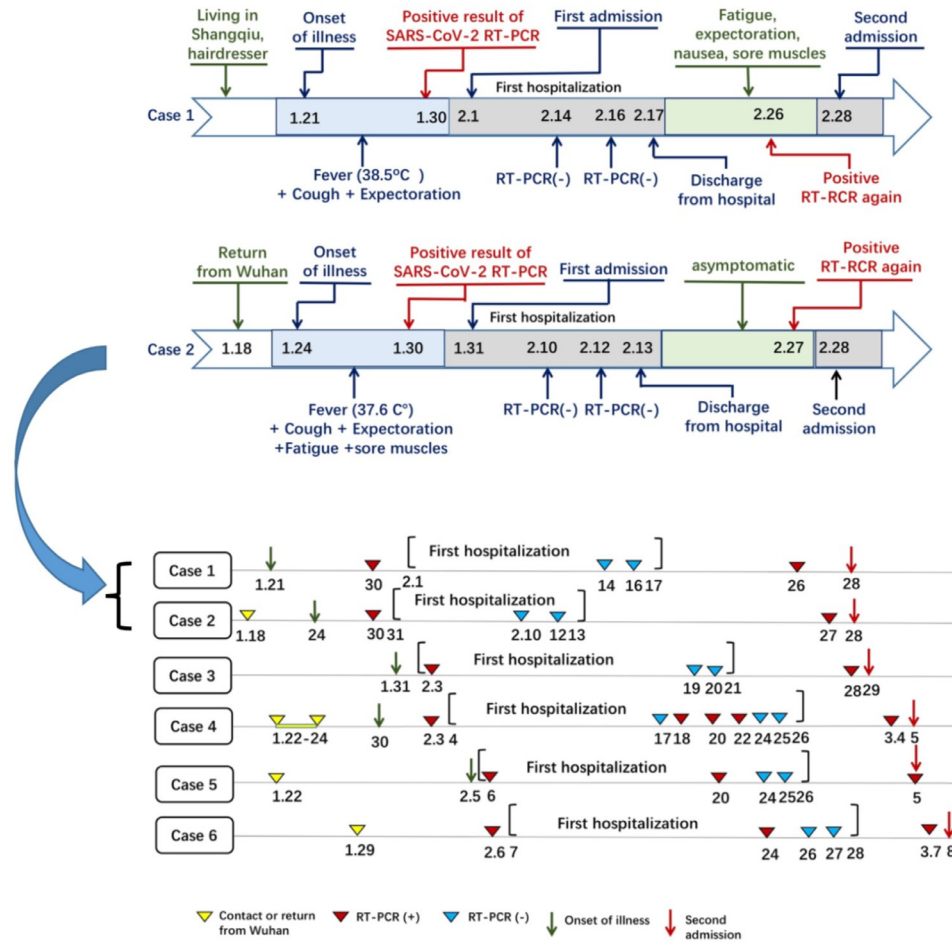


Fig. 1. Timeline of six recurrence cases.

Table 1 Levels of leukocyte, lymphocyte, neutrophil, platelet, and albumin between recurrence cases and cases without recurrence for more than two weeks.

	At first admission				Discharged from hospital			
	Recurrence (N = 6)	Control (N = 29)	t	p	Recurrence (N = 6)	Control (N = 29)	t	p
Leukocyte(109/L)	5.06 ± 1.95	5.92 ± 3.13	-0.646	0.523	5.68 ± 1.77	5.64 ± 1.49	0.059	0.953
Lymphocyte (109/L)	1.23 ± 0.61	1.50 ± 0.61	-0.972	0.338	1.69 ± 0.54	1.68 ± 0.52	0.033	0.974
Neutrophil (109/L)	3.26 ± 0.94	3.91 ± 2.85	-0.547	0.588	3.41 ± 1.37	3.41 ± 1.15	0.002	0.999
Platelet(109/L)	201.00 ± 88.56	221.66 ± 95.60	-0.487	0.629	279.17 ± 38.09	251.50 ± 88.43	0.744	0.462
Albumin(g/L)	36.20 ± 3.40	37.83 ± 6.18	-0.621	0.539	36.08 ± 3.40	37.25 ± 5.62	-0.473	0.64

Declaration of Competing Interest

None.

Acknowledgment

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The authors gratefully acknowledge the sample supply of Department of Respiratory of Shangqiu Municipal Hospital, as well as the useful statistical support of Yusai Zhang, Department of Respiratory of Shangqiu Municipal Hospital.

References

1. Tang JW, Tambyah PA, Hui DSC. Emergence of a novel coronavirus causing respiratory illness from Wuhan. China. *J Infect* 2020.
2. World Health Organization. Novel coronavirus (2019-nCoV). Situation Report—48 [https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200308-sitrep-48-covid-19.pdf?sfvrsn=16f7ccef\\_4](https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200308-sitrep-48-covid-19.pdf?sfvrsn=16f7ccef_4)
3. Huang C, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020;**395**(10223):497–506.
4. Graham RL, Donaldson EF, Baric RS. A decade after SARS: strategies for controlling emerging coronaviruses. *Nat Rev Microbiol* 2013;**11**(12):836–48.
5. Cumulative number of reported cases of 2019 novel coronavirus pneumonia. Beijing: National health commission of the People's Republic of China.2020[EB/OL]. [2020-02-29]. <http://www.nhc.gov.cn/xcs/yqfkdt/202002/4ef8b5221b4d4740bda3145ac37e68ed.shtml>

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Accepted 17 March 2020