A Case of Prolonged Shedding of SARS-Cov-2 with Rapid Decay of IgG Antibody

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Case Report

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A case of prolonged shedding of SARS-Cov-2 with rapid decay of IgG antibody

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Abstract

Background

Coronavirus disease 2019 (COVID-19) epidemic is still spreading rapidly around the world.

Recent cases with prolonged detection of SARS-CoV-2 RNA have been successively reported and the phenomenon of false-negative real-time polymerase chain reaction (RT-PCR) results of SARS-CoV-2 RNA or “repositive” was also described in patients with COVID-19.

Case presentation

A 69-year-old female with hypertension, total hysterectomy for hysteromyoma and suspected lung tumor presented with moderate COVID-19 symptoms was testing positive for SARS-CoV-2 RNA by RT-PCR when she travelled from USA to China. The patient required second and third re-hospitalization due to repositive SARS-CoV-2 test results of throat swaps during post-charge solitary isolation and observation. The serum SARS-CoV-2-IgG decayed rapidly and disappeared on illness day 139 when the throat swab was still positive for SARS-CoV-2 RNA. Finally the virus shedding lasted at least 146 days (the last positive test result of throat swap on illness day 146 and the first true-negative test result on illness day 151) from her initial positive test.

Conclusions

Prolonged viral shedding of SARS-CoV RNA is prone to occur in an immunocompromised host. With the change of host immune status, SARS-CoV-2 detection can be repeatedly positive. The SARS-CoV-2-IgG may decrease rapidly and disappear before the virus removal, indicating there may be certain limitations on the protective effect of antibody against SARS-CoV-2 which deserves attention of clinicians.

Keywords: Coronavirus disease 2019, False negative of RT-PCR, Prolonged viral RNA shedding, SARS-Cov-2, Antibodies

1 Background

2 Coronavirus disease 2019 (COVID-19) epidemic is still spreading rapidly around the world.
3 As of December 29, 2020, severe acute respiratory syndrome corona virus 2 (SARS-CoV-2)
4 infection has caused over 79 million cases and over 1.7 million deaths worldwide and the
5 epidemic continues to worsen in most countries ([https://www.who.int/em](https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports)
6 [ergencies/diseases/novel-coronavirus-2019/situation-reports](https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports)). As is known to all, testing
7 positive for SARS-CoV-2 RNA is the gold standard for the diagnose of COVID-19 [1] and
8 two consecutive negative for SARS-CoV-2 RNA test results are one of the criteria for
9 discharge.¹ A retrospective study of 301 patients with COVID-19 in China showed that the
10 median duration of viral shedding was 20 days from illness onset, whereas prolong virus
11 replication (>28 days) was found in 25 patients and the longest duration was 42 days [2].
12 Currently, some similar cases with prolonged detection of SARS-CoV-2 RNA have been
13 successively reported and the shedding duration lasted from 60 to 156 days [3-6].
14 Additionally, recent reports have also showed false-negative real-time polymerase chain
15 reaction (RT-PCR) results of SARS-CoV-2 nucleic acid or “repositive” phenomenon in
16 patients with COVID-19 [2,7-9]. Herein, we report a case of recovered COVID-19 patient
17 with repeating recurrence of positive SARS-CoV-2 RNA for at least 146 days (the last
18 positive test result on illness day 146 and the first true-negative test result on illness day 151)
19 and the gradual disappearance of IgG against SARS-CoV-2 before the virus removal.

20

21 Case description

22 A 69-year-old Chinese female travelled from New York, USA to Fuzhou Changle

23 International Airport, China on March 22th, 2020, and her throat swab specimen was positive
24 for SARS-CoV-2 RNA based on RT-PCR testing on the same day during routine screening.
25 She just felt slight fatigue and loss of appetite without cough, fever, dyspnea or other
26 infectious symptoms. The patient with a history of hypertension and total hysterectomy for
27 hysteromyoma was subsequently admitted to the negative pressure isolation room in Fuzhou
28 Pulmonary Hospital of Fujian Province which was the designated hospital of COVID-19
29 treatment the next day. The main laboratory examinations throughout the course of the
30 disease after onset are showed in table 1-3 and Fig. 1. Throat swab was tested again based on
31 qualitative RT-PCR assay which was performed using a COVID-19 nucleic acid detection kit
32 (Da An Gene Co.,Ltd. of Sun Yat-sen University, China) and the result was definitely
33 positive for SARS-CoV-2 RNA after hospitalization. The results of cardiac-associated
34 enzymes [creatinine kinase (CK), creatine kinase isoenzyme (CK-MB) and myohemoglobin
35 (MYO)] and Interleukin-6 (IL-6) showed increased on admission. Leukopenia,
36 thrombocytopenia and lymphopenia with obviously decreased T lymphocyte subgroups
37 including CD3⁺, CD4⁺, and CD8⁺ T cells in peripheral blood were also noted. Arterial blood
38 gas analysis showed a partial pressure of oxygen (PaO₂) of 80.6 mmHg, a partial pressure of
39 carbon dioxide (PaCO₂) of 36.9 mmHg and arterial oxygen saturation (SaO₂) 94.6% in the
40 air. C-reactive protein (CRP), erythrocyte sedimentation rate (ESR) and lactic dehydrogenase
41 (LDH) levels gradually increased during hospitalization. A human immunodeficiency virus
42 (HIV) antibody test was negative and procalcitonin (PCT) kept normal. Chest CT findings
43 showed as follow: (1) multiple patchy ground-glass opacities (GGOs) in both lungs
44 indicating viral pneumonia; (2) a nodular consolidation shadow (1.0 cm×0.7 cm in size)

45 with lobulated sign and spiculation in the dorsal lobe of the left lower lung (LLL-S⁶)
46 indicating suspected isolated lung tumor (Fig. 2A). A bedside echocardiography showed
47 aortic sclerosis, aortic valve thickening, normal left ventricular systolic function, tricuspid
48 regurgitation with mildly elevated pulmonary arterial pressure. Color doppler
49 ultrasonography of the whole abdomen revealed double renal cyst without other
50 abnormalities. Color doppler ultrasonography of the neck suggested the possibility of nodular
51 goiter without lymph node enlargement.

52 The patient was mainly diagnosed with confirmed moderate COVID-19 according to the
53 diagnostic criteria¹ and suspected early lung tumor with hypoxemia. She received antivirals
54 with abidor and recombinant human interferon α -2b spray and other therapeutic drugs
55 including traditional Chinese medicine, ulinastatin, thymalfasin, human granulocyte colony
56 stimulating factor, amlodipine, etc. She was also administering oxygen inhalation by nasal
57 cannula at 2L/minute. After 2 days of treatment, the patient developed cough and
58 expectoration although fatigue disappeared and appetite improved. On illness day 10 (9 days
59 after initial positive virus test), the patient's condition became better with the disappearance
60 of symptoms and the improvement of blood indexes (Table 1, 2). Repeated chest CT revealed
61 progress of partial lesions with absorption of partial lesions in both lungs (Fig. 2B). On
62 illness day 13, the detection of serum antibodies against SARS-CoV-2 based on gold
63 immuno-chromatography (GICA) which was performed using a COVID-19 antibody
64 detection kit [Inot (Tangshan) Biotechnology Co.,Ltd., China)] was positive for IgG and
65 negative for IgM. On illness day 32, repeated chest CT showed significant absorption of

66 infected lesions in both lungs (Fig. 2C). The throat swab samples were continuously negative
67 for SARS-CoV-2 RNA on illness days 34 and 37 and the patient was discharged on illness
68 day 38. According to the post-discharge isolation management¹, the patient was transferred to
69 the fixed isolation point for continuous solitary isolation and observation for 2 weeks.
70 On illness day 51 (the 14th day of the isolation observation after discharge), the patient's
71 throat swab was re-detectable positive (RP) for SARS-CoV-2 RNA, although she had no
72 special discomfort. She was transferred to our hospital again for solitary isolation on the
73 same day. Retest of IgG against SARS-CoV-2 was positive and the other laboratory results
74 were normal. Chest CT showed continuously absorption of residual infection lesions in both
75 lungs and the suspected cancerous nodule in the LLL-S⁶ was slightly larger than that before
76 (1.2 cm×0.9 cm in size). The patient was given antiviral drug with recombinant human
77 interferon α -2b spray, immunopotentiator with thymalfasin and hypotensive drugs with
78 amlodipine and benazepril. The throat swab test was still positive for SARS-CoV-2 RNA on
79 illness day 72. On illness days 76 and 80, the throat swabs were continuously negative for
80 SARS-CoV-2 RNA. The detection of IgG against SARS-CoV-2 was reduced to a weak
81 positive and the antibody titer was only 1:10 on illness day 81. The patient kept well and she
82 was discharged again to be continuous solitary isolation and observation at the fixed isolation
83 point for 2 weeks on illness day 81.
84 The sample of throat swab was rechecked with a negative result of SARS-CoV-2 RNA 14
85 days after the second discharge. Then the patient went home for continuous solitary isolation
86 and observation. Surprisingly, on illness day 110 (the 16th of home quarantine), the patient's
87 throat swab was RP for SARS-CoV-2 RNA again and she was transferred to our hospital

88 without any symptoms for the third times. Chest CT revealed that a small number of residual
89 infection lesions were similar to those before, and the initial solid nodule in the LLL-S⁶ was
90 slightly larger (1.4cm×1.0 cm in size). The re-detection of SARS-CoV-2- IgG was weakly
91 positive and the antibody titer was reduced to be 1:1 on illness day 110 (Tabel 2). Elevated of
92 CK, CK-MB and LDH levels and reduced T lymphocyte subgroups were noted again (Tabel
93 S1, 2 and Fig. 1). Tumor markers were normal. The serum 1,3-β-D-glucan (G) test,
94 galactomannan (GM) test and cryptococcus capsular antigen test were all negative. The
95 patient was treated with thymalfasin for immuno-enhancement and hypotensive drugs with
96 amlodipine and benazepril. After treatment, LDH, CK, CKMB and ESR all returned to
97 normal. T lymphocyte subgroups initially increased to normal, whereas the indexes declined
98 again after a while. On illness day 121, the titer of SARS-CoV-2- IgG remained 1:1.
99 However, the antibodies of IgG and IgM against SARS-CoV-2 were both negative on illness
100 day 139 (Table S2). An additional GICA test was performed using a kit from a different
101 manufacturer (Guangzhou Wondfo Biotech Co., Ltd., China) and the result was also
102 negative for IgG and IgM. Negative RT-PCR results of SARS-CoV-2 nucleic acid of throat
103 swabs were found on illness days 125 and 129, whereas the samples were RP on illness
104 days 132 and 146. On illness days 151, 153, 157 and 163, the throat swabs were
105 continuously negative for SARS-CoV-2 RNA. The re-detections of IgG and IgM against
106 SARS-CoV-2 remained negative on illness days 149 and 164. Meanwhile, repeated chest
107 CT revealed that a few residual infection lesions were similar to those before, and the initial
108 solid nodule in the LLL-S⁶ continuously enlarged (1.5cm×1.3 cm in size). On illness day
109 164, the patient was discharged to be continue solitary isolation and observation for the

third times at the fixed isolation point for 2 weeks and subsequent home quarantine for 2 weeks. The latest outpatient follow-up was September 30th, 2020 (the 190th day of illness onset), the patient remained well without recurrence, except for a slightly reduced T lymphocyte subgroups (Fig. 1 and Tabel 2).

Discussion

As seen in this case, the phenomenon of RP for SARS-CoV-2 RNA lasted for about 5 months after the onset of the disease. Although quantitative viral nucleic acid test, isolation of live virus and viral genome sequencing could not be performed due to the laboratory limitations in our hospital, the case was considered to be prolonged viral shedding but not a COVID-9 re-infection for several reasons as follows: First, the patient was quarantined alone after the first discharge, including the period of isolation and observation outside our hospital and the two re-hospitalizations, and she did not contact with any new source of infection. Second, except for the slight increase of LDH, CK, CKMB and ESR within a short time during the third hospitalization, the important inflammatory markers such as CRP and IL-6 kept normal after the first hospital discharge. Third, there were no new clinical symptoms or exacerbation of viral infection on dynamic chest CT after the first hospital discharge.

Prolong viral shedding in this case was considered to be related to the aging and the accompanying underlying diseases which might result in immune dysfunction [2,7], and the insufficient antiviral effect of IgG antibody. First, the solid nodule with lobulated sign and spiculation in the LLL-S⁶ gradually increased in size within 5 months while viral

132 pneumonia had been obviously absorbed, indicating a high probability of tumor. That was
133 to say, the elderly COVID-19 patient had three underlying diseases with hypertension, total
134 hysterectomy for hysteromyoma and suspected lung tumor. Moreover, the total lymphocyte
135 count and T lymphocyte subsets count were repeatedly decreased in dynamic monitoring.
136 All the above factors suggested cellular immune deficiency in this patient which was the
137 important reason of the difficulty in completely eliminating the virus [7,10]. Second, IgG
138 against SARS-CoV-2 in this patient was initially tested with positive result by qualitative
139 detection method on illness day 13, whereas the antibody concentration was only 1:10 based
140 on semi-quantitative detection method on illness day 81 during the second hospitalization,
141 indicating IgG antibody titer in vivo was already extremely low at that time. The titer of IgG
142 antibody continued to decline progressively to 1:1 on illness day 110 during the third
143 hospitalization, and it was undetectable by two different test methods on illness day 139
144 when the throat swab was still positive at that time. Although the peak of IgG antibody titer
145 in our patient was unknown at the beginning of the disease due to absence of quantitative
146 detection, it was certain that the IgG concentration had been at a very low level about 2.5
147 months after onset, which was similar to previous reports [11,12]. It was suggested the
148 ability of the IgG antibodies against SARS-CoV-2 decreased rapidly at the early course of
149 the disease and nearly disappeared at the middle and later course of the disease in this case.
150 Therefore, cellular immune deficiency and insufficient humoral immune response in the
151 older patient as seen in our case resulted in a prolonged virus removal. Additionally, as seen
152 in this patient, the immune status obviously fluctuated with frequent decrease of lymphocyte
153 during the whole course of the disease. Reduced immunity could cause repeat increase of

154 the number of viruses in the body, which appeared as the phenomenon of intermittent virus
155 replication [13]. This may explain alternately positive and negative results of SARS-CoV-2
156 detection in this patient.

157

158 **Conclusions**

159 This case suggests prolonged virus shedding is prone to occur in an immunocompromised
160 host [5, 6]. With the change of host immune status, SARS-CoV-2 detection can be
161 repeatedly positive. A recent case report has confirmed that SARS-CoV-2 can persistently
162 survive with repeat replication more than 5 months after initial infection [6], suggesting that
163 prolonged virus shedding could be associated with prolonged infectivity. Therefore, for
164 such patients, it is necessary to increase the frequency of SARS-CoV-2 nucleic acid testing
165 and enhance the post-discharge isolation management and health monitoring [1]. Notably,
166 the titer of IgG antibody in this case decayed rapidly at the early course of disease onset and
167 the antibody completely disappeared less than 5 months after disease onset before the virus
168 removal, indicating that there may be certain limitations on the protective effect of antibody
169 against SARS-CoV-2, especially in immuno-compromised hosts. As is known to all, most
170 of the current vaccine studies take antibody response as the main evaluation index of
171 vaccine efficacy. However, except for a strong anti-SARS-CoV antibody response, inducing
172 a strong virus-specific memory T cell response should be the future direction of vaccine
173 research [14,15].

174

175 **Abbreviations**

176 COVID-19: Coronavirus disease 2019; SARS-CoV-2: severe acute respiratory syndrome
177 corona virus 2; RT-PCR: real-time polymerase chain reaction; CK: creatine kinase; CK-MB:
178 creatine kinase isoenzyme; (MYO: myohemoglobin; IL-6: Interleukin-6; PaO₂: partial
179 pressure of oxygen; PaCO₂: partial pressure of carbon dioxide; CRP: C-reactive protein;
180 ESR: erythrocyte sedimentation rate; LDH: lactic dehydrogenase; HIV: human
181 immunodeficiency virus; PCT: procalcitonin ; GGOs: ground-glass opacities; LLL-S⁶: the
182 dorsal lobe of the left lower lung; GICA: gold immnnochromatography; RP: re-detectable
183 positive; G: 1,3-β-D-glucan; GM: galactomannan

184

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187 Fuzhou Pulmonary Hospital of Fujian.

188

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192 Control in Fuzhou of Fujian, P.R.C. in 2020 (2020-XG-20).

193

194 **Authors' Contributions**

195 JBH and CQL managed the data generation and data analysis and drafted the manuscript.
196 MXH helped to carry out laboratorial data collection. XHW conceived of the study and

197 reviewed all drafts of the manuscript. JBH and CQL contributed equally as senior authors.

198 All authors read and approved the final manuscript.

199

200 **Availability of data and materials**

201 No

202

203 **Ethics approval and consent to participate**

204 The study was approved by the Ethics Committee of Fuzhou Pulmonary Hospital of Fujian

205 (17th Mar, 2020, No. 2020-021-01), and the participant provided written informed consent.

206

207 **Consent for publication**

208 Yes

209

210 **Competing interests**

211 The authors declare that they have no competing interests.

212

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262 **Figure Legends**

263

264 Fig 1 Dynamics of T-lymphocyte subgroups and total lymphocyte after illness onset. After
265 the treatment of first hospitalization, T-lymphocyte subgroups and total lymphocyte initially
266 increased to normal, whereas the indexes repeatedly declined during the later course of the
267 disease.

268

269 Fig 2 Dynamics of Chest CT findings after illness onset. (A) On illness day 2, Chest CT
270 findings showing as follow: (1) multiple patchy ground-glass opacities (GGOs) in both
271 lungs indicating viral pneumonia; (2) a nodular consolidation shadow (1.0 cm×0.7 cm in
272 size) with lobulated sign and spiculation in the dorsal lobe of the left lower lung (LLL-S⁶)
273 indicating suspected isolated lung tumor (arrow). (B) On illness day 10, repeated chest CT
274 showing progress of partial lesions with absorption of partial lesions in both lungs and the
275 suspected cancerous nodule in the LLL-S⁶ was similar to that before. (C) On illness day 32,
276 repeated chest CT showing significant absorption of infected lesions in both lungs and the
277 initial solid nodule in the LLL-S⁶ was similar to that before.

Table 1. Dynamics of laboratory indexes

Day of illness	IL-6, pg/mL	CRP, mg/L	ESR, mm/h	WBC, $\times 10^9/L$	NEU, $\times 10^9/L$	PLT, $\times 10^9/L$	LYM, $\times 10^9/L$	SaO ₂ , %	LDH, U/L	CK, U/L	CK-MB, ng/ml	TYO, ng/ml
2 (March 23 th , 2020)/First hospitalization	N	4.0	21	2.64	1.58	94	0.79	94.6	215	368	5.73	244
3 (March 24 th)	6.7	3.4	27	2.18	1.10	84	0.76	94.0	218	275	2.80	51
4 (March 25 th)	<1.5	12.5	43	5.30	3.95	103	0.83	95.4	283	193	1.89	37
7 (March 28 th)	2.0	2.2	38	4.13	2.49	161	0.97	95.6	275	153	2.32	48
10 (March 31 th)	<1.5	0.8	60	3.62	2.34	217	1.00	96.0	261	110	1.61	35
13 (Apri 3 rd)	<1.5	0.3	N	4.08	2.47	225	1.16	96.9	218	82	N	N
15 (Apri 5 th)	N	0.4	23	4.26	2.59	174	1.13	N	170	85	N	N
31 (Apri 21 th)	N	0.9	38	6.06	4.69	176	0.86	97.8	199	128	N	N
38 (Apri 28 th)/First hospital discharge	N	N	N	N	N	N	N	N	N	N	N	N
51 (May 11 th)/ Second hospitalization	N	0.5	21	4.69	3.08	173	1.17	97.6	182	105	N	N
53 (May 12 th)	N	0.6	22	4.11	2.11	198	1.52	N	167	99	N	N
81 (June 10 th) /Second hospital discharge	?	0.7	36	4.72	2.98	213	1.4	96.9	196	133	N	N
95 (June 24 th)/Out-patient foll ow-up	2.0	0.3	31	4.95	3.35	155	1.15	97.7	223	262	3.69	44
110 (July 9 th) /Third hospitalization	N	0.7	27	4.84	3.06	226	1.26	97.4	203	13	1.45	25
121 (July 20 th)	<1.5	0.5	20	4.91	3.07	224	1.36	97.0	169	118	N	N
128 (July 27 th)	N	N	N	5.73	3.50	220	1.58	N	N	N	N	N
149 (August 17 th)	<1.5	0.8	N	4.11	2.33	202	1.27	N	N	N	N	N
164 (September 1 st)/ Third hospital discharge	N	0.7	33	4.91	3.36	193	1.03	96.6	205	375	N	N
178 (September 14 th)	N	0.9	23	4.13	2.73	191	0.97	96.5	218	366	N	N
194 (September 30 th)/ Last follow-up												

CK: Creatine kinase; CK-MB: Creatine kinase isoenzyme; CRP: C-reactive protein; ESR: Erythrocyte sedimentation rate; IL-6: Interleukin-6; LDH: Lactate dehydrogenase; LYM: Lymphocyte; MYO: Myohemoglobin; N: Absence of test; NEU: Neutrophil; PLT: Platelet; SaO₂: Arterial oxygen saturation; WBC: White blood cell *Reference of IL-6 is 0-7 pg/mL; Reference of CRP is <10 mg/L; Reference of ESR is 0-20 mm/h; Reference of WBC is 3.5-9.5 $\times 10^9/L$; Reference of NEU is 1.8-6.3 $\times 10^9/L$; Reference of PLT is 125-350 $\times 10^9/L$; Reference of LYM is 1.1-3.2 $\times 10^9/L$; Reference of SaO₂ is $\geq 95\%$; Reference of LDH is 115-220 U/L; Reference of CK is 24-190 U/L; Reference of CK-MB is <3.61 ng/ml; Reference of MYO is 28-72 ng/ml

Table 2. Dynamics of T-lymphocyte subgroups, total lymphocyte and serum antibodies

Day of illness	CD3 ⁺ T-LYM, / μ L	CD4 ⁺ T-LYM, / μ L	CD8 ⁺ T-LYM, / μ L	Total LYM, / μ L	CD4 ⁺ / CD8 ⁺	IgM- QD	IgG- QD	IgG-SQ D
1 (March 22 th , 2020)/ Disease onset	N	N	N	N	N	N	N	N
2 (March 23 th)/First hospitalization	639	302	303	753	1.0	N	N	N
7 (March 27 th)	668	294	354	836	0.83	N	N	N
12 (April 1 st)	807	437	347	997	1.26	N	N	N
14 (April 3 rd)	848	476	362	1034	1.31	—	+	N
21 (April 10 th)	1239	617	558	1542	1.11	—	+	N
25 (April 14 th)	N	N	N	N	N	—	+	N
38 (April 28 th)/First hospital discharge	N	N	N	N	N	N	N	N
51 (May 11 th)/Second hospitalization	N	N	N	N	N	—	+	N
53 (May 13 th)	1441	655	753	1752	0.87	N	N	N
62 (May 22 th)	N	N	N	N	N	—	+	N
81 (June 10 th) /Second hospital discharge	1255	647	582	1506	1.11	—	+	1:10
95 (June 24 th)/ Out-patient follow-up	1274	599	645	1478	0.93	N	N	N
110 (July 9 th) /Third hospitalization	865	410	441	1193	0.93	N	N	1:1
121 (July 20 th)	1080	509	542	1303	0.94	—	+	1:1
139 (August 7 th)	1395	680	679	1729	1.0	—	—	N
149 (August 17 th)	N	N	N	N	N	—	—	N
164 (September 1 st)/ Third hospital discharge	1055	475	554	1319	0.86	—	—	N
178 (September 14 th)	908	399	485	1154	0.82	N	N	N
194 (September 30 th)/ /Last follow-up	912	459	453	1112	1.01	N	N	N

LYM: Lymphocyte; N: Absence of test; QD: Qualitative detection; SQD: Semi-quantitative detection; +: Positive for IgM or IgG against SARS-CoV-2; —: Negative for IgM or IgG against SARS-CoV-2. *Reference of CD3⁺ LYM is 955–2860/ μ L; Reference of CD4⁺ LYM is 550–1440/ μ L; Reference of CD8⁺ LYM is 320–1250/ μ L; Reference of CD8⁺ LYM is 1530–3700/ μ L; Reference of CD4⁺/CD8⁺ is 0.64–2.85

Table 3. Dynamics of RT-PCR test of SARS-Cov-2 RNA

Day of illness	Throat swab	Anal swab
1 (March 22 th , 2020) / Disease onset	+	N
2 (March 23 th) / First hospitalization	+	N
9 (March 30 th)	+	N
14 (April 4 th)	+	N
18 (April 8 th)	+	N
21 (April 11 th)	+	N
25 (April 15 th)	+	N
34 (April 24 th)	—	N
37 (April 27 th)	—	N
38 (April 28 th) / First hospital discharge	N	N
51 (May 11 th) / Second hospitalization	+	N
58 (May 18 th)	+	N
64 (May 24 th)	+	N
69 (May 29 th)	+	N
72 (June 1 st)	—	—
76 (June 5 th)	—	—
80 (June 9 th)	N	N
81 (June 10 th) / Second hospital discharge	—	N
94 (June 23 th)	+	—
110 (July 9 th) / Third hospitalization	+	—
111 (July 10 th)	—	—
118 (July 17 th)	—	—
125 (July 24 th)	+	—
129 (July 28 th)	+	N
132 (July 31 th)	—	—
146 (August 14 th)	—	—
151 (August 19 th)	—	—
153 (August 21 th)	—	—
157 (August 25 th)	N	N
163 (August 31 th)	—	N
164 (September 1 st) / Third hospital discharge	—	N
177 (September 14 th)		
191 (September 28 th) / Last follow-up		

N: Absence of test; +: Positive for SARS-CoV-2 RNA; —: Negative for SARS-CoV-2 RNA

Figures

Figure 1

Dynamics of T-lymphocyte subgroups and total lymphocyte after illness onset. After the treatment of first hospitalization, T-lymphocyte subgroups and total lymphocyte initially increased to normal, whereas the indexes repeatedly declined during the later course of the disease.

Figure 2

Dynamics of Chest CT findings after illness onset. (A) On illness day 2, Chest CT findings showing as follow: (1) multiple patchy ground-glass opacities (GGOs) in both lungs indicating viral pneumonia; (2) a nodular consolidation shadow (1.0 cm×0.7 cm in size) with lobulated sign and spiculation in the dorsal lobe of the left lower lung (LLL-S6) indicating suspected isolated lung tumor (arrow). (B) On illness day 10, repeated chest CT showing progress of partial lesions with absorption of partial lesions in both lungs and the suspected cancerous nodule in the LLL-S6 was similar to that before. (C) On illness day 32, repeated chest CT showing significant absorption of infected lesions in both lungs and the initial solid nodule in the LLL-S6 was similar to that before.