

# SARS-CoV-2 Delta VOC pneumonia with CT follow-ups: A case report

To the Editor,

Coronavirus Disease 2019 (COVID-19) as a new type of virus broke out in China and quickly swept the world in December 2019.<sup>1,2</sup> The virus then mutated to Alpha (B.1.1.7), Beta (B.1.351), Gamma (P.1), and Delta (B.1.617.2).<sup>3,4</sup> The World Health Organization (WHO) has outlined three key criteria to designate the Delta Variant of Concern (VOC): increased transmissibility, increased virulence, and decreased effectiveness of available diagnostics, vaccines, and therapeutics.<sup>5</sup> The Delta VOC caused an epidemic and outbreak in Nanjing and then spread across several provinces and cities in China.<sup>6</sup>

## 1 | CASE REPORT

A 54-year-old male patient took a flight from Moscow to Nanjing at Nanjing Lukou Airport on July 10, 2021. Nasopharyngeal nucleic acid test results at the airport were negative. On July 14, the patient was admitted to our hospital due to a fever (38°C), accompanied by headache, fatigue, and muscle aches. The nucleic acid test was positive after admission. The white blood cells were normal, the percentage of neutrophils was 75.9%, the percentage of lymphocytes was 10.4%, the absolute value of lymphocytes:  $0.72 \times 10^9/L$ , C-reactive protein 3.02 mg/L. A total of four computed tomography (CT) examinations were performed in our hospital, as shown in Figure 1. All CT examinations were performed with a 16-section scanner (Toshiba) without injecting contrast media. The radiation dose for CT scan was 120 kV/129 mAs/278.59 mGy-cm. The patient's symptoms and laboratory tests are shown in Tables S1 and S2. The current study was approved by the Research Ethics Committee of the Second Hospital of Nanjing.

The first vertical images are the initial CT (2021-7-19, Figure 1A), showing multiple lesions in bilateral pulmonary, all of which are small nodules. The local magnification is shown in Figure 1 (A1–A5) to help readers observe them. The lesions appear as ground-glass nodules (GGN) in A1 and A4, or nodules with halo signs in A2, A3, and A5. This is the earliest typical manifestation of SARS-CoV-2 Delta VOC pneumonia. The second vertical images are the follow-up CT (2021-7-23, Figure 1B), which corresponds to the same level of panel A. Compared with previous CT, the density and size of nodules increase

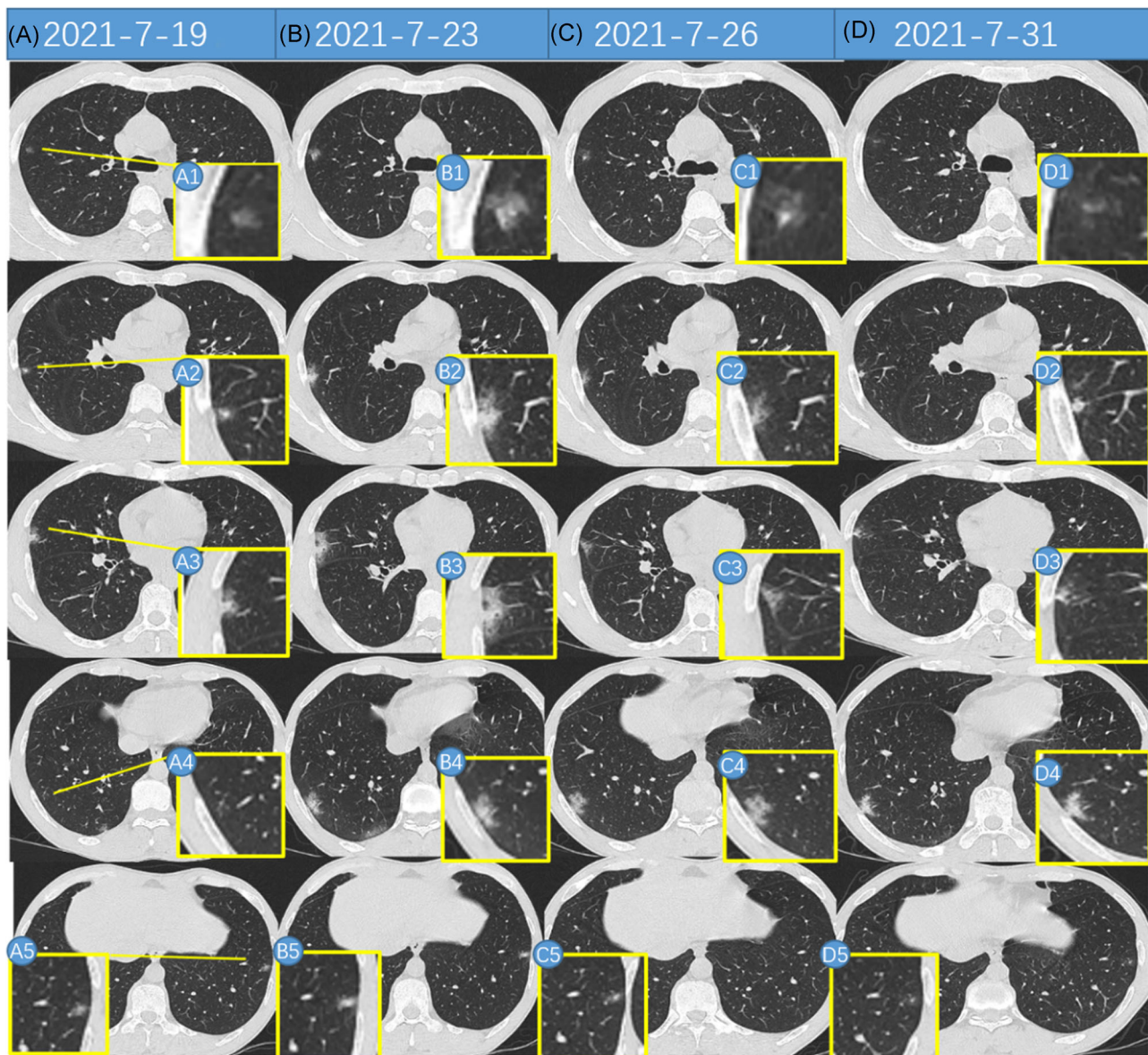
(B5), and some of the nodules appear to fuse into patches, as shown in Figure 1 (B1–B4). The distribution is mainly in the secondary lung lobules and peripheral lung zone. The third vertical images are the follow-up CT (2021-7-26, Figure 1C). C1–C5 correspond to the same level as the previous CT. Through the local enlargement, the lesion becomes smaller, indicating that the lesion has improved. The fourth vertical images are follow-up CT (2021-7-31, Figure 1D). Lesions were further reduced by contrasting the same level with the previous images (D1–D5), and the edge was straight, like D4, indicating that the lesion has entered the repair period.

## 2 | DISCUSSION

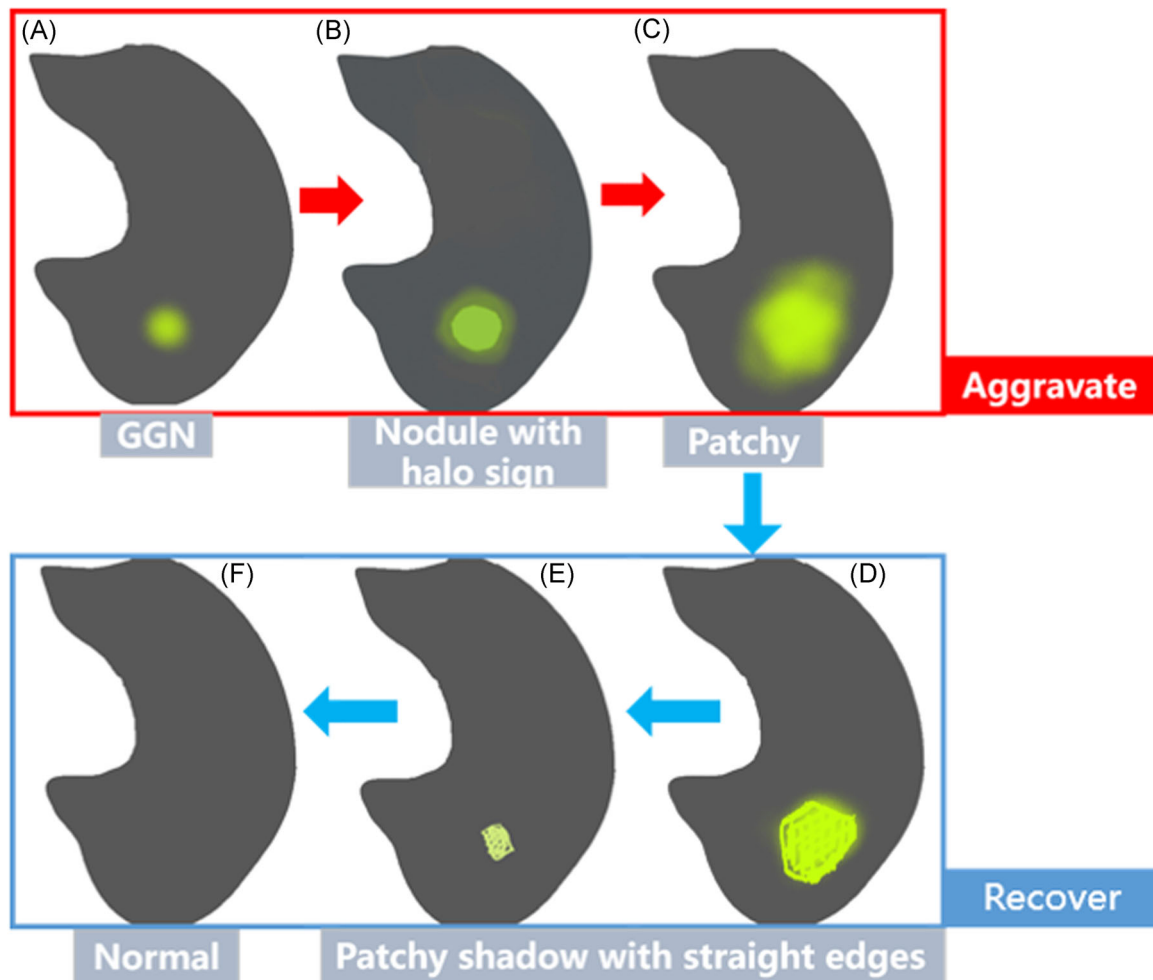
The early manifestation is ground-glass opacity (GGO), with the distribution of secondary lung lobules mainly as per Figure 2A. With the aggravation, the size and density of the lesion increase may form nodules with halo signs as in Figure 2B. Then the nodules merge into patches as Figure 2C. If the disease further aggravates, diffuse high-density shadows could be found, which mostly happened in severe patients.<sup>7</sup> As the disease improves, the patchy high-density shadow gradually shrinks, and the edges may appear straight, as in Figures 2D,E, or there may be a fine grid sign inside, or a striped shadow around it, which indicates that the disease has entered the repair period and is gradually absorbed as in Figure 2F.

In this case, the boundary of GGO is blurred.<sup>8</sup> Other viruses, such as influenza viruses, are more manifested as GGO distributed under the pleura of bilateral lungs, rather than secondary lung lobules, and fewer nodules can be found.<sup>9,10</sup> As for the CT difference between unmutated COVID-19 and delta variant pneumonia, there is no literature report, and further research is needed.

This report introduces a typical case of SARS-CoV-2 Delta VOC pneumonia through multiple follow-up CT. The early manifestations were GGN or nodules with halo signs with the distribution of secondary lung lobules and then fused into patches. CT examination can be used as a supplementary method for the diagnosis, and to judge and evaluate the development of the disease.



**FIGURE 1** Multiple follow-up computed tomography (CT) images of a typical case of the SARS-CoV-2 Delta Variant of Concern. (A) The first vertical images are the initial CT of 2021-7-19, multiple lesions in bilateral pulmonary, all of which are small nodules. The local magnification is shown in A1–A5. The lesions appear as ground-glass nodules or nodules with halo signs. (B) The second vertical images are the follow-up CT of 2021-7-23, which corresponds to the same level of panel A. Compared with the previous CT, the density and size of nodules increase in B1–B5, and some of the nodules appear to fuse into patches in B1–B4. (C) The third vertical images are the follow-up CT of 2021-7-26. C1–C5 correspond to the same level as the previous CT. Through the local enlargement, the lesion becomes smaller, indicating that the lesion has improved. (D) The fourth vertical images are the follow-up CT of 2021-7-31. Lesions were further reduced by contrasting the same level with the previous images in D1–D5, and the edge was straight in D4, indicating that the lesion has entered the repair period



**FIGURE 2** (A–F) are schematic diagrams drawn according to the development of multiple nodules in this case to show the most common changes in SARS-CoV-2 Delta Variant of Concern (VOC) pneumonia. (A) The initial computed tomography (CT) manifestation, which is the ground-glass nodules in the center of the secondary pulmonary lobule. With the aggravation of the disease, it further exudes and forms (B). The nodule becomes larger and the density increases and the halo sign can be accompanied around it. With the further aggravation of the lesion, the nodules fuse into patchy high-density shadow (C). With the improvement of the lesion, the exudation decreases, the size of the lesion decreases, and the edge of the patchy shadow is straight, suggesting that the fibrosis is in progress during the repair period (D). The lesion was further reduced as in (E), until it was finally absorbed, and the lung was normal as (F). This is the most common development process of SARS-CoV-2 Delta VOC pneumonia

#### CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

#### AUTHOR CONTRIBUTIONS

Jing Wu and Jie Tang are co-first authors of this paper, they collected the data, analyzed the data, and draft the paper for the work. Tao Zhang helped to acquire the clinical and imaging data. Chao Du and Yu-Chen Chen are co-corresponding authors of this paper, they did the financial support, review, and final approval of the paper to be published. All authors read and approved the final manuscript.

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**DATA AVAILABILITY STATEMENT**

The data used and analysed during the current study are available from the corresponding author on reasonable request.

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