

# World Journal of *Clinical Cases*

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## Bullectomy used to treat a patient with pulmonary vesicles related to COVID-19: A case report

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### Abstract

#### BACKGROUND

The corona virus disease 2019 (COVID-19) has been a pandemic for more than one year and estimated to affect the whole world in the near future.

#### CASE SUMMARY

Here we reported that one COVID-19 patient with vesicles was treated by bullectomy. The patient's perioperative laboratory tests were analyzed. The pathological findings of bullectomy were described and compared with those of common bulla cases.

#### CONCLUSION

This patient with vesicles underwent bullectomy and had a poor prognosis. He showed diffuse alveolar damage and extensive necrosis in bullectomy specimen.

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We hope our report will be of interest for clinicians who will treat COVID-19 patients in the future.

**Key Words:** Corona Virus Disease 2019; Pulmonary vesicle; Surgical treatment; Case report

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**Core Tip:** We reported that one corona virus disease 2019 (COVID-19) patient with vesicles was treated by bullectomy. The patient's perioperative laboratory tests were analyzed. The pathological findings of bullectomy were described and compared with those of common bulla cases. This patient with vesicles underwent bullectomy and had a poor prognosis. He showed diffuse alveolar damage and extensive necrosis in bullectomy specimen. We hope our report will be of interest for clinicians who will treat COVID-19 patients in the future.

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## INTRODUCTION

Pulmonary bullae are cavities more than one centimeter in diameter in the lung that form from structurally damaged lung tissue due to a variety of etiologies[1]. When nonoperative approaches for pulmonary bullae are ineffective, in some cases, surgical resection can be considered[2,3].

Corona virus disease 2019 (COVID-19) presents with a severe phenotype in as many as 26% of patients. Medical therapy is lacking, and many of these patients require intubation and even extracorporeal life support[4]. COVID-19 mainly attacks the lungs and other organs that express angiotensin-converting enzyme 2 receptors[5]. Patients with pneumonia who are infected with COVID-19 have been reported to develop pulmonary vesicles and tension pneumothorax with the use of ventilators. Pulmonary vesicles are defined as peripheral predominant consolidation patterns with internal round cystic changes[6]. Because of the high risk of health care worker transmission and the difficulty in performing an operation with full personal protective equipment, operations for patients infected with COVID-19 are quite difficult; thus, these operations are extremely rare. Recently, we performed a bullectomy under special circumstances as the last option to treat a patient.

## CASE PRESENTATION

### Chief complaints

Intermittent fever for 1 wk.

### History of present illness

The patient suffered from chest tightness and chest pain due to infection with COVID-19 5 d ago. He urgently went to the local hospital to see a doctor. The perfect chest X-ray showed a right pneumothorax, and the patient's dyspnea was progressively worsening. The local hospital gave an emergency tracheal intubation, connected to a ventilator to assist breathing, and transferred him to our intensive care unit for treatment.

### History of past illness

Denies the history of diabetes, heart disease, etc. Denies the history of infectious diseases such as tuberculosis and hepatitis. Denies the history of food and drug



allergy. Denies the history of trauma surgery.

### **Personal and family history**

Denies the family history of genetic disease.

### **Physical examination**

T 38.3 °C, P 85 bpm, HR 20 bpm, diastolic blood pressure: 69 mmHg, systolic blood pressure: 116 mmHg, mentally clear, good spirits, no yellowing of skin and mucous membranes throughout the body, and superficial lymph nodes less than swollen. Pharyngeal is not congested, breath sounds in both lungs are clear, heart rhythm is uniform, no pathological murmurs are heard in each valve area. HR 85 bpm, the heart rhythm is uniform, no pathological murmur is heard in each valve area. Abdomen is soft, no tenderness and rebound pain, liver, spleen and ribs are not in reach, Murphy sign is negative, there is no percussion pain in the kidneys, no redness and swelling of the limbs and joints, and no edema of the lower limbs.

### **Laboratory examinations**

T lymphocyte (%) [February 24, 2020] 87.67, [March 12, 2020] 73.15; Helper/inducible T lymphocytes (%) [February 24, 2020] 39.09, [March 12, 2020] 60.97; NK cells (%) [February 24, 2020] 4.55, [March 12, 2020] 7.73; Interleukin-6 (pg/mL) [February 24, 2020] 2.46, [March 12, 2020] 211.33; Interleukin-10 (pg/mL) [February 24, 2020] 29.22, [March 12, 2020] 122.35; White blood cells ( $\times 10^9/L$ ) [February 22, 2020] 21.99, [March 11, 2020] 6.88; Red blood cells ( $\times 10^{12}/L$ ) [February 22, 2020] 3, [March 11, 2020] 3.61; hemoglobin (g/L) [February 22, 2020] 92.0, [March 11, 2020] 116.0; platelet ( $\times 10^9/L$ ) [February 21, 2020] 154, [March 11, 2020] 22; Alanine aminotransferase (U/L) [February 21, 2020] 41, [March 10, 2020] 56; Aspartate aminotransferase (U/L) [February 21, 2020] 58, [March 10, 2020] 89.

### **Imaging examinations**

The X-ray before bullectomy: Infection of both lungs, massive pneumothorax on the right side; The chest CT scan before bullectomy: Severe infection of both lungs, extensive bullae; The X-ray after bullectomy: The X-ray before bullectomy: Both lung infections, the right pneumothorax improved significantly.

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## **FINAL DIAGNOSIS**

Spontaneous pneumothorax, Respiratory failure, lung infection with COVID-19, Septic shock, ARDS.

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## **TREATMENT**

Received ECMO support, underwent a bullectomy.

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## **OUTCOME AND FOLLOW-UP**

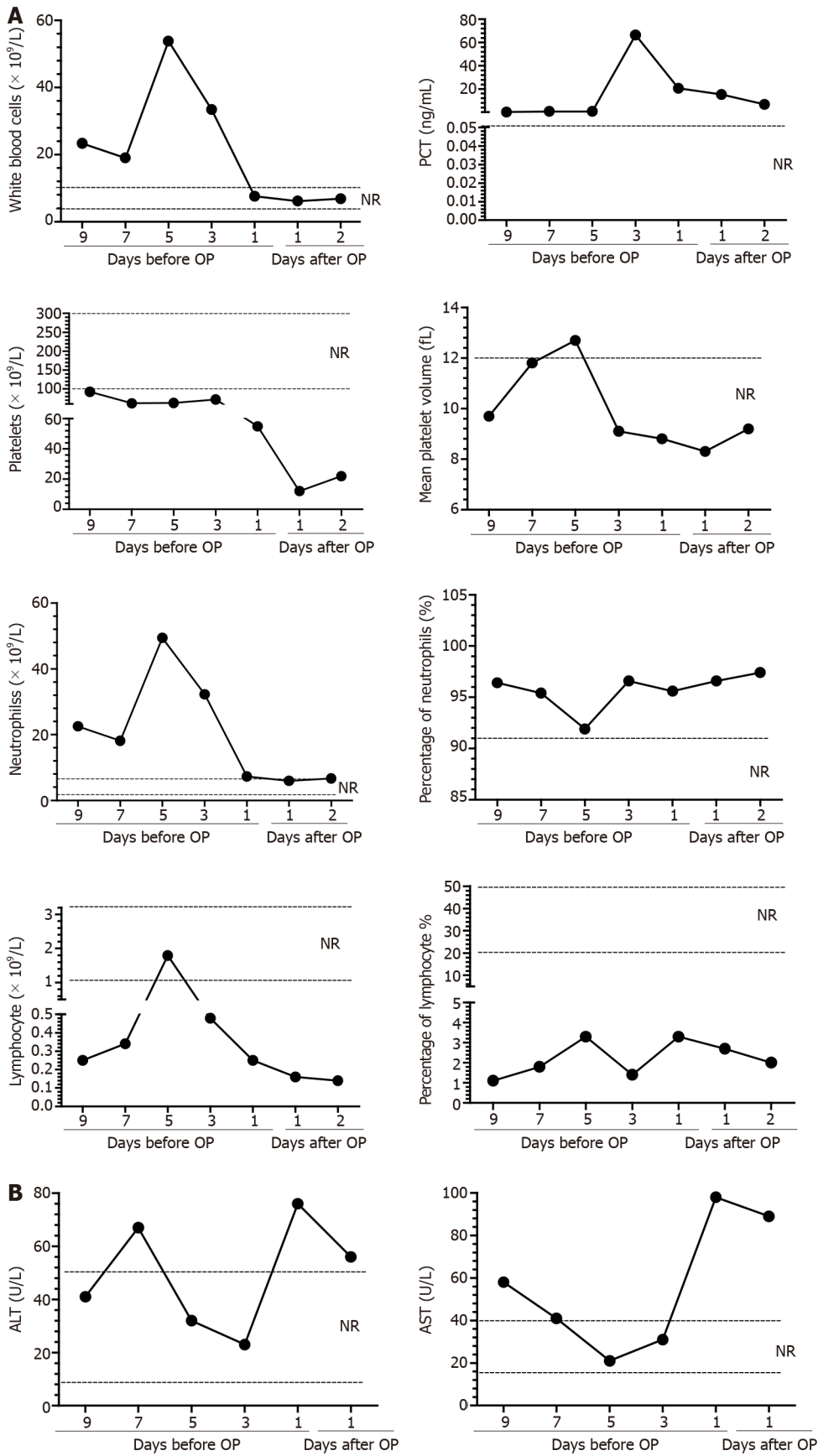
This patient with vesicles underwent bullectomy and had a poor prognosis. He showed diffuse alveolar damage and extensive necrosis in bullectomy specimen.

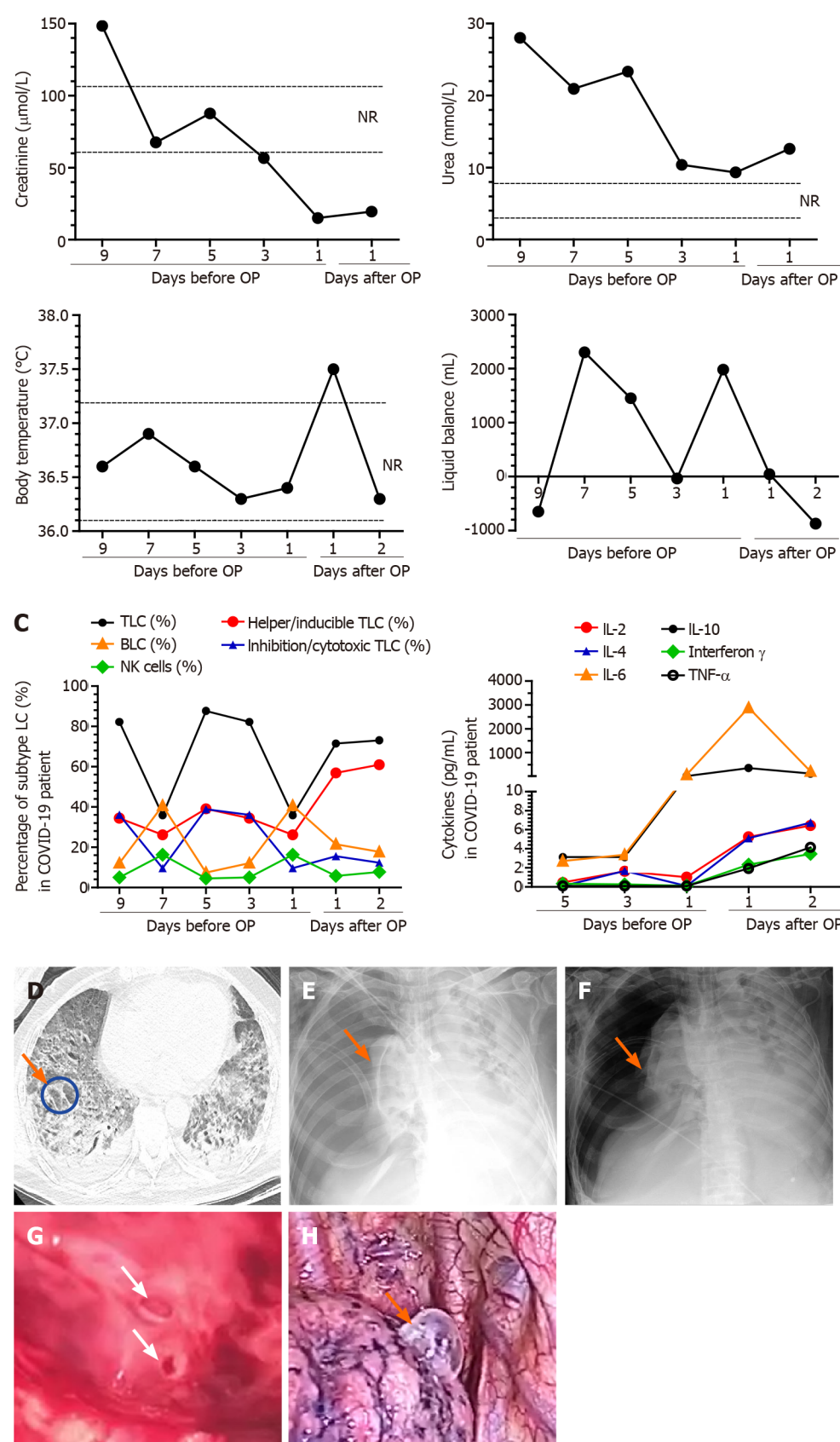
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## **DISCUSSION**

The etiology of pulmonary bulla is complex and includes chronic obstructive pulmonary disease, emphysema, ventilator-related lung injury, and COVID-19[1]. Patients who have pulmonary vesicles shown on chest CT scans, and peripheral predominant consolidation patterns with internal round cystic changes[6], are more prone to pulmonary bullous formation. However, the influence of COVID-19 on pulmonary vesicles has not yet been reported.

Our study found that as alveolar structure destruction occurred quickly, the wall of the air cavity was significantly thicker than that of common pulmonary bulla (Figure 1G and H). In this process, the inflammatory storm is also an important factor





**Figure 1** Perioperative laboratory tests on patient underwent surgery. A: Perioperative blood routine results showed that COVID-19 patient with pulmonary vesicles showed higher rate of infections, fewer platelets, more neutrophils and fewer lymphocytes. B: After receiving surgery, the TLC and I/CLC in the patient's circulating blood showed a "W-shaped" curve, NK cells and BLC showed an "M-shaped" curve, H/I LC showed a trend of increasing gradually, and cytokines (IL-2, 4, 6, 10, Interferon  $\gamma$ , TNF  $\alpha$ ) showed an upward trend as a whole. C: The level of circulating estrogen was higher than the normal range, while the level of ACE was in the normal range. The COVID-19 patient with pulmonary vesicles showed varying degrees of liver and kidney damage, mild body temperature elevation, and large changes in fluid intake and output. D: 20 d before bullectomy, the chest CT scans of the patient showed changes in small vesicles in the lung. E: Chest X-ray,

before bullectomy. F: Chest X-ray, after bullectomy. G: The pulmonary vesicles of the patient during the bullectomy. H: A common pulmonary bulla. NR: Normal range; PCT: Procalcitonin; TLC: T lymphocyte; BLC: B lymphocyte; I/CLC: Inhibition/cytotoxic T lymphocytes; NK cells: Natural killer cells; H/I LC: Helper/inducible T lymphocytes.

[4]. Thus, we believe that the destruction of alveolar structure due to COVID-19 easily induces emphysema and then causes the formation of pulmonary vesicles.

Although pulmonary vesicles are not exactly bulla, they can easily develop into them. The most effective approach to treat symptomatic pulmonary bulla is surgical resection[7], which is widely accepted by thoracic surgeons worldwide. Nevertheless, it was a difficult choice for treating COVID-19 patients with pulmonary vesicles. It is clear that when patients have tension pneumothorax, chest drainage tubes must be placed as soon as possible. In this study, one patient underwent bullectomy, with pulmonary vesicles induced by COVID-19 and tension pneumothorax. To our knowledge, this operation was the first bullectomy performed on a COVID-19 patient with both gross and histologic findings. Regrettably, the outcome of this patient was poor after undergoing bullectomy (Figure 1F).

This is also the first report on pathological findings of COVID-19 complicated by emphysematous bulla formation in the lung. Interactions of multiple factors, including diffuse alveolar damage overlapping with extensive necrosis, abundant neutrophils in lung tissue that can produce matrix metalloproteinase, and elevated levels of cytokines such as interleukins in the peripheral blood, may have led to bulla formation in this case.

## CONCLUSION

In conclusion, COVID-19 may induce the formation of pulmonary vesicles, which have a thicker air cavity wall than common bulla. Considering ventilator-related lung injury, it is recommended to choose the ventilator mode and PEEP carefully. Based on the extensive destruction of lung tissue by COVID-19, the use of bullectomy is limited, only as a last resort and trial treatment if the patient accepts. More research is needed to explore the specific mechanisms of pulmonary vesicle formation to improve the efficacy of COVID-19 pneumonia treatment, especially in patients with severe COVID-19 with vesicles.

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