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Clinical data of early COVID-19 cases receiving extracorporeal membrane oxygenation in Wuhan, China

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Since the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) first identified in Wuhan, China in December 2019, the epidemic has been presenting a global pandemic trend. About 20–30% of patients develop severe illness with the main manifestation of acute respiratory distress syndrome (ARDS) [1]. Extracorporeal membrane oxygenation (ECMO), a useful tool providing support for failing lung and/or heart to help critically ill patients through dangerous period, is recommended for COVID-19 patients with refractory ARDS. However, the clinical data of COVID-19-ECMO-related patients is limited at this point. Herein, we reported early three ECMO-related cases of severe COVID-19 patients in Wuhan.

IRB approval and informed consent from the patients or their next of kin were obtained. Patients’ characteristics and outcome are showed in Table 1. Initial presentation of admission mainly was respiratory symptoms including cough and/or dry cough, sputum, shortness of breath and tightness, with rapid deterioration of respiratory function, leading to mechanical ventilation and venous-venous (VV) ECMO. Multiple pulmonary infection-like lesions were the common findings on chest CT. Laboratory examination results of all patients showed lymphopenia, neutrophil nucleus shift left, increased inflammatory reaction markers (ESR, CRP), and other abnormalities are also common such as electrolyte, myocardial enzymes, and coagulation function (viewed in Supplementary material). Besides ECMO treatment, all patients also received antibiotics, antivirals, Chinese medicine, and immunomodulatory drugs; patient 1 and patient 2 also received hormone therapy. Regrettably, Patient 1 and patient 2 died despite active treatment. Patient 3 was transferred to a higher-level hospital due to persistent non-improvement of lung conditions and suspicious ventilator-induced lung injury (VILI). According to later press, Patient 3 subsequently experienced a darkened face in a coma and underwent lung transplantation. He is currently transferred to a local hospital for recovery training. Patients’ clinical course was presented in Timeline 1.

Available literature suggested the mortality rate was up to 94.1% in COVID-19-ECMO-related patients, which was in line with our report [2]. As we reported, aged from 58 to 65 years, Patient 1 and Patient 2 had underlying diseases, otherwise patient 3 appeared to be healthy. Yang et al. showed that patients older than 65 with comorbidities are at increased risk of death [3]. Lymphopenia is a significant feature of severe COVID-19 patients, which occurs in 80% of them. Viral particles can target the cytoplasmic components of invading lymphocytes to cause their destruction [4]. In addition, ECMO operation usually causes lymphopenia due to complex immune damage accompanied by activation of extracorporeal circuit. Considering the importance of lymphocyte filling for resistance to SARS-CoV-2, the decision of using ECMO should be made more cautiously in COVID-19 patients with significant lymphopenia [5]. In our report, Patient 1 died of sudden respiratory and circulatory failure and patient 2 died due to multiple organ dysfunction. Patient 3, without basic disease, his situation is gradually improving after active treatment. Indeed, ECMO can provide respiratory and cardiac support but cannot treat the underlying pathologic condition.

In view of high mortality rate of severe COVID-19 patients, ECMO may have certain therapeutic benefits. However, the actual results indicated that the clinical benefits are limited, while the application may increase the medical burden, especially during the epidemic. Therefore, we must carefully choose the indications of ECMO. Early use of ECMO...
for younger patients without underlying diseases is the most recommended. ECMO is a complex and high-risk method that may lead to complications such as bleeding, infection, and limb ischemia. It should be done in centers with enough experience, quantity, and expertise to ensure safe use. Anyway, ECMO mustn't charge ahead to replace measures such as epidemic quarantine and prevention and control, oxygen inhalation, blood oxygen monitoring.

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CRedit authorship contribution statement

SQH, HFX, HLL and XDC contributed substantially to the article concept and manuscript writing. SQH, HFX and SZ retrieved relative literature and review manuscript. SLY and ZYW provided care for critically ill patients and collected clinical data. XDC and HLL revised and approved the final version before submission. All the listed authors have participated actively in the study, and have read and approved the final manuscript.

Declaration of competing interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
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