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Letter to Editor

Patients with severe novel coronavirus pneumonia: From treatment to prevention



To the editor,

In most COVID-19 patients, the main clinical manifestations of infection are fever, fatigue, and a dry cough. And some will progress to become patients with severe COVID-19 pneumonia, leading to ARDS, circulatory failure, and multi-organ dysfunction and need to be transferred to the Intensive Care Unit (ICU) for treatment.

COVID-19 Primary injury mainly invades epithelial cells through angiotensin-converting enzyme 2(ACE2). Thus cellular shedding and apoptosis occur after injury, promoting proliferation of pulmonary fibroblast and increasing pulmonary vascular permeability, which play an important role in inducing lung injury in acute viral pneumonia. Secondary injuries are mainly correlated with inappropriate stress response, abnormally driven autonomic respiration and increased circulatory kinetics, together with mechanical ventilation-related injuries. These will result in a simultaneous increase in trans-pulmonary pressure and trans-vascular pressure accompanied by a concomitant increase in pulmonary blood flow,

which will lead to significant interstitial microvascular endothelial cell injury and increased fluid leakage and exudates in addition to continued alveolar epithelial cell injury. With the occurrence of distribution of the gravity-dependent lesions, treatment and secondary injury may exacerbate each other, forming a vicious cycle. This may be an important factor in the development and progression of acute respiratory distress syndrome(ARDS) in patients with COVID-19.¹

Therefore, how to protect the organs, reduce the incidence of stress and secondary injury are important measures to prevent the development in patients with COVID-19.

Restrictive fluid management strategy has been proven to be beneficial in patients with ARDS.² In patients with mild COVID-19, avoiding fluid overload and restrictive fluid therapy based on sufficient organ perfusion is particularly important. While the awake prone position is effective in rapidly improving the oxygen saturation in patient.³

It is determined by the characteristics of secondary injury in

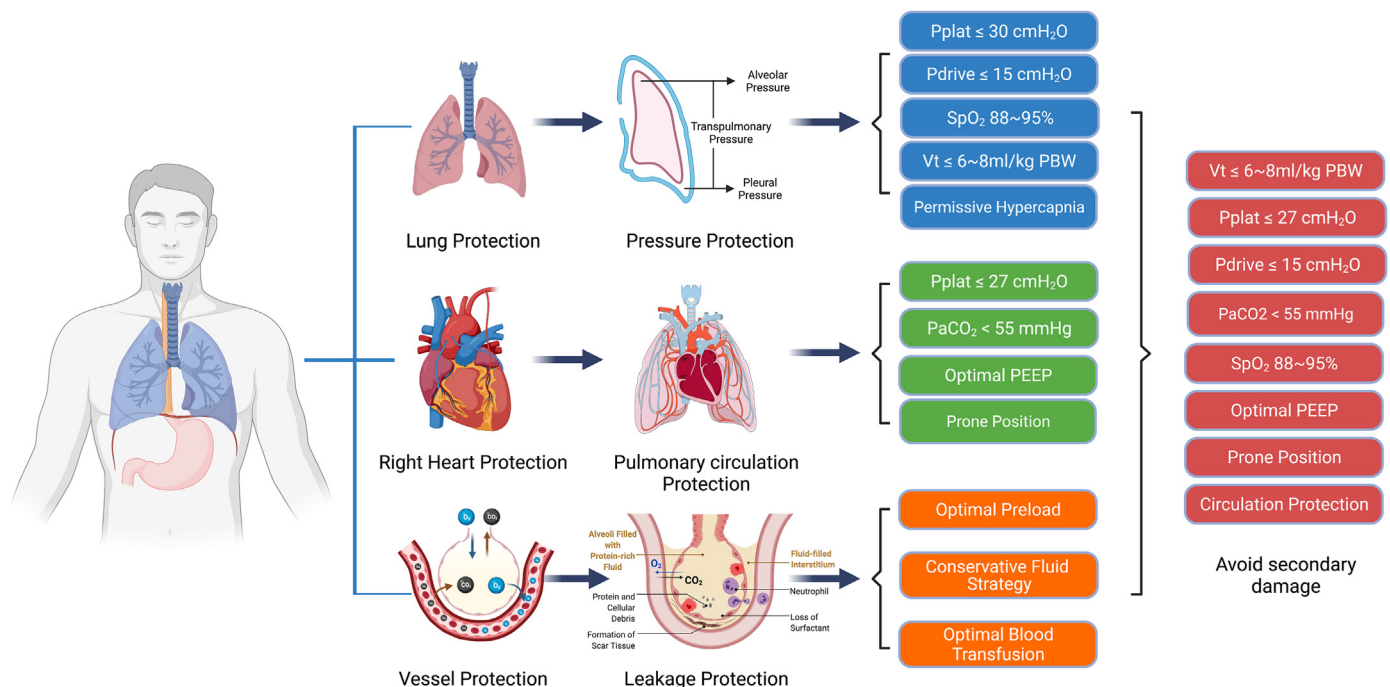


Fig. 1. Comprehensive lung protection measures.

Table 1

List of prevention of lung injury.

Content of list of prevention of lung injury	Best measures
Adequate empirical antibiotic therapy and primary disease control	According to the suspected infection site, medical exposure and immunosuppression
Liquid management strategy	Conservative liquid management strategy to avoid liquid overload
Awake prone position	According to patient tolerance, actively implement
Lung protection	VT < 6–8 mL/kg PBW Pplat ≤ 27 cm H ₂ O Pdrive ≤ 15 cm H ₂ O PaCO ₂ < 55 mmHg In the early stage of shock, FiO ₂ is minimized when SpO ₂ is maintained at 88–92% Appropriate PEEP Prone position
Antistress drug	β-blocker Dexmedetomidine
Precautions for prevention of aspiration	Endotracheal intubation is performed quickly by experienced doctors Keeping head high Oral care with chlorhexidine Neutralizing gastric acid Reevaluating noninvasive ventilation as early as possible to prevent delayed intubation
Limiting liquid overload	Conservative fluid management strategy is used in the early stage of shock (the first 12 hours) Hb > 7 g/dL Plasma donors mainly male
Evaluation of extubation possibility	Reducing sedation conditions and conducting spontaneous breathing test as soon as possible
Ultrasound evaluation of severe disease	Assessment of lung, circulation and other organs

Definition of abbreviation: VT = tidal volume; P_{plat} = platform pressure; PEEP = positive end-expiratory pressure; Hb = hemoglobin.

patients with COVID-19 that the injury may be aggravated if the excessive blood flow pass through the pulmonary vessels. Therefore, pulmonary vascular protection and leakage and exudates protection is also one of the key treatments to prevent further deterioration of the disease during the development. Ultimately, through a combination of the above measures, further aggravation of secondary injuries and deterioration of the condition can be avoided (Fig. 1).

There still exist some other lung protection measures as follows:

①Administration of the anti-stress drugs, e.g., β-blockers, dexmedetomidine, etc. ②Airway management: Rapid tracheal intubation by an experienced medical staff, keeping the head of patient in an elevated position, oral care with chlorhexidine, gastric acid management, and early reassessment of noninvasive ventilation to prevent delayed intubation. ③Restrictive blood transfusion with a target of maintaining hemoglobin above 70 g/L ④Daily assessment, early discontinuation of ventilator and extubation of tracheal intubation, etc. ⑤Critical ultrasonography(CUS) evaluation. CUS plays an important role in the management of patients with COVID-19 (Table 1).

When treating COVID-19, clinicians should be aware of the importance of preventing ARDS. Correct the primary injury while avoiding secondary injury. A series of clinical interventions, such as adequate empirical antibiotic treatment and primary disease control, restrictive fluid management, lung protection, prevention

of aspiration, and early extubation of tracheal intubation, critical care ultrasound assessment, are recommended.

References

- Wang XT, Zhang LN, Liu DW. [Recognition of critical coronavirus disease 2019: from the injury of alveolar epithelial cells to vascular endothelial cells]. *Zhonghua Nei Ke Za Zhi*. 2020;59:660–661.
- Lee J, Corl K, Levy MM. Fluid therapy and acute respiratory distress syndrome. *Crit Care Clin*. 2021;37:867–875.
- Coppo A, et al. Feasibility and physiological effects of prone positioning in non-intubated patients with acute respiratory failure due to COVID-19 (PRON-COVID): a prospective cohort study. *Lancet Respir Med*. 2020;8:765–774.

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