

An emergency strategy for intensive care unit during COVID-19 outbreak in Chongqing, China

W. DENG^{1,2}, D. QI^{1,2}, D.-X. WANG^{1,2}

¹Department of Respiratory and Critical Care Medicine, Second Affiliated Hospital of Chongqing Medical University, Chongqing, China

²Chongqing Medical Research Center for Respiratory and Critical Care Medicine, Chongqing, China

Abstract. – OBJECTIVE: Since December 2019, a novel coronavirus disease 2019 (COVID-19) broke out in Wuhan, China, which has rapidly spread from China to at least 200 countries abroad. COVID-19 was issued a global outbreak and pandemic by the World Health Organization with more than 3 million confirmed cases by May 31, 2020. So far more than ten thousand severe and critically ill patients and hospital-related infection with COVID-19 have been reported with more than four thousand deaths in China. There is a great challenge for intensive care units (ICUs) in hospitals.

PATIENTS AND METHODS: The comment mainly focused on admission and discharge criteria, therapy protocol, prevention and control strategies for ICU during COVID-19 outbreak. The emergency strategy for ICU will be helpful for prevention and control of COVID-19 and treatment of critically ill patients with COVID-19.

CONCLUSIONS: Progress in the management of ICU is crucial for a decrease in the mortality of critically ill patients with COVID-19 with the clinical evidence and experience updated.

Key Words:

Coronavirus disease 2019, Intensive care unit, Emergency strategy.

least 200 countries abroad. A novel coronavirus disease 2019 (COVID-19) was identified with similar clinical manifestations to severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS)¹. In the clinical epidemiology, the characteristics of respiratory droplets and close contact transmission from human to human have been confirmed². More than ten thousand cases were severe and critically ill patients with the predominant complication of acute respiratory distress syndrome (ARDS)³. 28-day mortality of critically ill patients with COVID-19 in intensive care unit (ICU) was 61.5%, higher than those with SARS or MERS⁴. With the increasing deaths of severe patients infected COVID-19, intensive care unit (ICU) management is crucial for the survival⁵. Of the 576 confirmed cases in Chongqing China, 6 deaths were reported in all severe and critically ill patients with COVID-19. We aim to propose an emergency strategy for ICU, mainly focused on admission and discharge criteria, therapy protocol, prevention and control strategies during COVID-19 outbreak.

Abbreviations

ARDS: Acute respiratory distress syndrome; COVID-19: coronavirus disease 2019; MERS: Middle East respiratory syndrome; RICU: respiratory intensive care unit; SARS: severe acute respiratory syndrome.

Introduction

In December 2019, an unknown pneumonia broke out in Wuhan, Hubei Province, China, which has rapidly spread from China to at

Patients and Methods

Patients with confirmed COVID-19 presenting the following situations should be considered admission for ICU: (1) dyspnea and respiratory distress (2) $\text{PaO}_2/\text{FIO}_2 < 300$ mm Hg (3) Bilateral ground-glass opacity, or areas of consolidation progression $>50\%$ within 24-48 hours (4) acute respiratory failure or ARDS requires mechanical ventilation (5) shock (6) multiple organ failure. Patients with older age and underlying chronic comorbidity indicated a high risk for ICU admission⁶.

General management comprises hemodynamics and homeostasis maintenance, early nutritional support, close follow-up of laboratory indicator and chest radiography, and initiation of lung protection if necessary. There is no effective antiviral drug or vaccine against COVID-19 attribute to a new infectious disease occurred in less than two months. Sputum and bronchoalveolar lavage fluid could be helpful for bacteria or fungi infection to guide the application of antimicrobial drugs. Glucocorticoid therapy still remains uncertain for COVID-19. Currently no clinical evidence supports glucocorticoid in the treatment of COVID-19-induced lung injury or shock⁷. The anatomy of first COVID-19 with ARDS showed the pathological manifestations with pulmonary edema and hyaline membrane formation which indicated appropriate use of glucocorticoids could be considered⁸. For patients who developed ARDS, lung-protective ventilation, recruitment maneuver, prone position and nitric oxide inhalation might be effective. In critically ill patients, extracorporeal membrane oxygenation should be implemented if necessary⁹.

Improved oxygenation, consciousness, withdrawal from mechanical ventilation, unnecessary vasoactive drugs and fluid resuscitation, none organ failure and resolution of previously abnormal chest radiography findings could be considered the discharge from RICU to general wards. The score of Acute Physiology and Chronic Health Evaluation II, Sequential Organ Failure Assessment and Glasgow Coma Scale score should be helpful for evaluation of disease severity.

Since rapid person-to-person transmission of COVID-19 with hospital-related transmission

and infection may have occurred³, strict precautions should be implemented in the ICU (Table I). All patients newly admitted to the ICU must be screened for high risk of COVID-19 infection including family history with confirmed COVID-19, close contact with probable or confirmed COVID-19, history of residence and tour in epidemic area, close contact with wild animals or animal markets within two weeks before the onset of illness. Patients at high risk should be isolated in a single room for at least two weeks. Virus nucleic acid tests from throat-swab specimens and IgM plus IgG assay in blood samples should be performed to confirm the COVID-19. If a patient is highly suspected of COVID-19 infection on admission or develops similar symptoms as COVID-19 during the isolation period, a designated hospital or unit should be immediately planned for transfer. The patient's ward should be adequately disinfected. All the wardmates should be isolated at least two weeks before COVID-19 infection excluded.

More than 11000 critical care medical staff have been sent to Wuhan, China; however, it is still difficult to cope with the rapidly increasing number of critically ill patients with COVID-19 that required therapy in ICU. Medical staff, life support equipment and protective device should be reasonably and adequately prepared. A COVID-19 outbreak will bring psychological stress to patient's family members and medical staff in ICU. Medical staff will endure overtired, heavy work, medical resource shortage, so psychology and mental health services should be provided for them during COVID-19 outbreak.

Table I. Emergency strategies for ICU during COVID-19 outbreak.

Strict precautions should be implemented in the ICU
1. Marked clean area, semi polluted area and polluted area at the entrance, strict hand hygiene, daily disinfection of the ward, personal protective equipment including N95 mask, gloves, goggles and protective clothing.
2. Enhanced contact isolation and respiratory droplet isolation include isolation room for ventilated patient, a designated equipment for each patient, medical protective hood for intubated patient, closed tracheal suction catheter for patient with invasive ventilation, proper sedation combined with neuromuscular blocker before tracheal intubation, provision of mask for patients with oxygen therapy, air exchange regularly in the ward.
3. Thoroughly disinfection of the medical equipment used by patients, preparation of a double-layer infectious waste bag for medical waste treated with chlorine-containing disinfectant, disposition of medical waste as infectious medical waste.
4. Prior use of chlorine-containing disinfectant for patient's ward as terminal disinfection.

Conclusions

Our suggestions are summarized based on existing and previous lessons during coronavirus outbreaks in China. Progress in the management of ICU is crucial for decrease in the mortality of critically ill patients with COVID-19 with the clinical evidence and experience updated.

Conflict of Interest

The Authors declare that they have no conflict of interests.

Funding Sources

This work is supported by grant from the National Natural Science Foundation of China (81600058 and 81670071), grants from the Clinical Medical Study Program of Chongqing Medical University, China (XGFY-2019-040) and Key projects of Chongqing Medical University, China (XGFY-2019-06).

Authors' Contribution

WD interpreted the data and drafted the manuscript. DQ performed the literature search. DXW proposed the idea of the manuscript. Both authors read and approved the final manuscript.

References

- 1) KANNAN S, SHAIK SYED ALI P, SHEEZA A, HEMALATHA K. COVID-19 (Novel Coronavirus 2019) - recent trends. *Eur Rev Med Pharmacol Sci* 2020; 24: 2006-2011.
- 2) CHAN JF, YUAN S, KOK KH, TO KK, CHU H, YANG J, XING F, LIU J, YIP CC, POON RW, TSOI HW, LO SK, CHAN KH, POON VK, CHAN WM, IP JD, CAI JP, CHENG VC, CHEN H, HUI CK, YUEN KY. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *Lancet* 2020; 395: 514-5233.
- 3) WANG D, HU B, HU C, ZHU F, LIU X, ZHANG J, WANG B, XIANG H, CHENG Z, XIONG Y, ZHAO Y, LI Y, WANG X, PENG Z. Clinical characteristics of 138 hospitalized patients with 2019 Novel coronavirus-infected pneumonia in Wuhan, China. *JAMA* 2020; 323: 1061-1069.
- 4) YANG X, YU Y, XU J, SHU H, XIA J, LIU H, WU Y, ZHANG L, YU Z, FANG M, YU T, WANG Y, PAN S, ZOU X, YUAN S, SHANG Y. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. *Lancet Respir Med* 2020; 8: 475-481.
- 5) DU RH, LIU LM, YIN W, WANG W, GUAN LL, YUAN ML, LI YL, HU Y, LI XY, SUN B, PENG P, SHI HZ. Hospitalization and critical care of 109 decedents with COVID-19 pneumonia in Wuhan, China. *Ann Am Thorac Soc* 2020 Apr 7. doi: 10.1513/AnnalsATS.202003-225OC. [Epub ahead of print].
- 6) GUAN WJ, LIANG WH, ZHAO Y, LIANG HR, CHEN ZS, LI YM, LIU XO, CHEN RC, TANG CL, WANG T, OU CO, LI L, CHEN PY, SANG L, WANG W, LI JF, LI CC, OU LM, CHENG B, XIONG S, NI ZY, XIANG J, HU Y, LIU L, SHAN H, LEI CL, PENG YX, WEI L, LIU Y, HU YH, PENG P, WANG JM, LIU JY, CHEN Z, LI G, ZHENG ZJ, QIU SQ, LUO J, YE CJ, ZHU SY, CHENG LL, YE F, LI SY, ZHENG JP, ZHANG NF, ZHONG NS, HE JX; CHINA MEDICAL TREATMENT EXPERT GROUP FOR COVID-19. Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis. *Eur Respir J* 2020; 55: 2000547.
- 7) RUSSELL CD, MILLAR JE, BAILLIE JK. Clinical evidence does not support corticosteroid treatment for 2019-nCoV lung injury. *Lancet*. 2020; 395: 473-475.
- 8) XU Z, SHI L, WANG Y, ZHANG J, HUANG L, ZHANG C, LIU S, ZHAO P, LIU H, ZHU L, TAI Y, BAI C, GAO T, SONG J, XIA P, DONG J, ZHAO J, WANG FS. Pathological findings of COVID-19 associated with acute respiratory distress syndrome. *Lancet Respir Med* 2020; 8: 420-422.
- 9) ZHAN WQ, LI MD, XU M, LU YB. Successful treatment of COVID-19 using extracorporeal membrane oxygenation, a case report. *Eur Rev Med Pharmacol Sci* 2020; 24: 3385-3389.