Severe Acute Respiratory Syndrome Associated Coronavirus 2

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Abstract

This mini review provides a brief overview on the pathogenesis and laboratory diagnosis of Severe Acute Respiratory Syndrome Associated Coronavirus 2 (SARS-CoV-2) that has unleashed the pandemic Covid 19, managing to spread across the globe crippling the health and economic affairs of the world.

Abbreviations: SARS-CoV, MERS-CoV, CoVID-19, CCR, INF, ORF, Nsp, MHC, IL

Introduction

The CoVID-19 caused by a novel strain of coronavirus, known as Severe Acute Respiratory Syndrome Associated Coronavirus 2 (SARS-CoV-2), has spread worldwide. The first incidence of the disease as clustered outbreak, reported in the Wuhan city of China during early December 2019 originated in the Huanan Seafood Market [1].

Pathogenesis

The spread of SARS-CoV-2 is by close person to person contact, through infectious droplets and fomites. The SARS-CoV-2 infection mainly progress through three phases corresponding to different clinical stages after onset. The 1st asymptomatic stage may last for early 1 to 3 days. Here, the inhaled virus attaches to the respiratory cells and undergo replication but with limited innate immune response. During the next stage the virus propagates along the respiratory tract triggering a more robust immune response in the conducting airways, however majority of the infected patients might show mild to moderate infection in the upper respiratory tract during this phase [2]. Clinical manifestations range from fever, unproductive cough, fatigue, diarrhea, myalgia, sore throat, lymphopenia to severe pneumonia [3]. The third stage progresses to pulmonary destruction with hypoxia and acute respiratory distress syndrome [2]. The infiltrated lung and damaged alveoli shows multinucleated giant cells containing macrophages and cells of epithelial origin along with numerous characteristic syncytium like formation [4].

Laboratory diagnosis

Specimen collected are nasopharyngeal (OP) and/or oropharyngeal (ON) swabs using dracon or polyester swabs from the upper respiratory tract (URT), sputum or bronchoalveolar lavage (BAL) or endotracheal aspirate collected in sterile containers from lower respiratory tract (LRT). [5]. Other specimens including rectal swabs, stool, urine and blood in appropriate sterile containers as recommended by the WHO. Paired sera during acute (1st week of illness) and convalescent phase (2 or 3 weeks later) should be collected for serological assay whenever possible. Specimens in viral transport medium should be immediately shipped after triple packaging maintaining proper cold chain. It can be maintained at refrigerated temperature for up to 72 h, or frozen at −70°C or below in case longer transport is expected [6].

Serological assay including Enzyme-linked immunosorbent assays (ELISA), rapid antibody immunochromatographic tests, point-of-care test (POCT)-fluorescence assays, and chemiluminescence immunoassays (CLIAs) detects viral antigens or antibodies against the viral antigens in the specimens [7]. The viral antigens mostly used in serological assays are the N protein, S protein and RBD of the S protein. Sensitivity wound be higher if N and S proteins are used together [8]. The sensitivity of serology tests for total antibody, IgM and IgG were 100.0%, 94.3% and 79.8%, respectively during 15 to 39 days after onset (later phase) while RNA was detectable only in 45.5% of the samples from 15 to 39 days [9].

The viral load is highest during the initial phase and decreases afterwards in NP swabs requiring lower pre-specified Ct value and fewer replications cycle than when viral load is lower [10]. Primers for gene encoding the structural proteins, ORFs and RNA dependent RNA polymerase are provided by WHO and different countries follow different protocols. Specimens of poor quality with little patient materials, very early or late collection, improper handling during transportation, repeated thawing leading to non-maintenance of cold chain and other technical factors inhibiting RNA amplification or detection can give faulty results [8]. Other molecular methods such as loop-mediated isothermal amplification, multiplex isothermal amplification followed by microarray detection, and CRISPR (clustered regularly interspaced short palindromic repeats)-based assays are also being evaluated [11].

Conclusion

Susceptible populations such as health care providers should be made aware of the guidelines and protective measures recommended by WHO. Accurate diagnosis of the disease and preventive measures are important to appropriately treat and contain the spread of the disease.

Conflict of Interest: There is no clash of concern.

Reference

[1] M. S. Nadeem et al., "Origin, potential therapeutic targets and treatment for coronavirusdisease(COVID-19)," Pathogens, vol. 9, no. 4. MDPIAG, 01-Apr-2020.

[2] R. J. Mason, "Pathogenesis of COVID-19 from a cell biology perspective," European Respiratory Journal, vol. 55, no. 4. 2020.

[3] X. Li, M. Geng, Y. Peng, L. Meng, and S. Lu, "Molecular immune pathogenesis and diagnosis of COVID-19," Journal of Pharmaceutical Analysis, vol. 10, no. 2. 2020.

[4] H. A. Rothan and S. N. Byrareddy, "The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak," Journal of Autoimmunity, vol. 109. 2020.

[5] P. K. C. Cheng et al., "Viral shedding patterns of coronavirus in patients with probable severe acute respiratory syndrome," Lancet, vol. 363, no. 9422, 2004.

[6] T. Singhal, "A Review of Coronavirus Disease-2019 (COVID-19)," Indian Journal of Pediatrics, vol. 87, no. 4. 2020.

[7] M. Nuccetelli et al., "SARS-CoV-2 infection serology: a useful tool to overcome lockdown?," Cell Death Discov., vol. 6, no. 1, 2020.

[8] Y. W. Tang, J. E. Schmitz, D. H. Persing, and C. W. Stratton, "Laboratory diagnosis of COVID-19: Current issues and challenges," Journal of Clinical Microbiology, vol. 58, no. 6. 2020.

[9] R. Wölfel et al., "Virological assessment of hospitalized patients with COVID-2019," Nature, vol. 581, no. 7809, 2020.

[10] V. C. C. Cheng et al., "Escalating infection control response to the rapidly evolving epidemiology of the coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 in Hong Kong," Infect. Control Hosp. Epidemiol., vol. 41, no. 5, 2020.

[11] M. J. Loeffelholz and Y. W. Tang, "Laboratory diagnosis of emerging human coronavirus infections–the state of the art," Emerging Microbes and Infections, vol. 9, no. 1. 2020.

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