

GUIDE TO INFECTION CONTROL IN THE HEALTHCARE SETTING

The 2019 Coronavirus Disease (COVID-19) and its Causative Agent, SARS-CoV-2

Authors

Jaffar A. Al-Tawfiq, MD, FRCP, FACP; and Ziad A. Memish, MD, FRCP, FACP

Chapter Editor

Gonzalo Bearman, MD, MPH

Topic Outline

Key Issues

Known Facts

Controversial Issues

Suggested Practice

Suggested Practice in Under-Resourced Settings

Summary

References

Chapter last updated: December 2023

KEY ISSUES

The Coronavirus Disease (COVID-2019) is caused by the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2). SARS-CoV-2 emerged in Wuhan city, Hubei, China in December 2019. The initial event was related to a cluster of pneumonia cases associated with a seafood market, a wet food market where many different products apart from seafood were sold. The outbreak was reported officially to the World Health Organization (WHO) at the end of December 2019 following isolation of SARS-CoV-2 from the affected patients. The virus causing COVID-19 was named SARS-CoV-2 and was classified as belonging to lineage B of the genus Betacoronavirus and was closely related to the known SARS-CoV. Soon, the genomic sequence of this virus was made available to scientists worldwide. The virus caused a global pandemic as declared by the WHO on March 11, 2020. The pandemic had caused significant disruption globally and had caused 765,222,932 global infections including 6,921,614 deaths. The WHO declared the end of the COVID-19 as a public health emergency on May 5, 2023, following the 15th meeting of the COVID-19 IHR Emergency Committee.

KNOWN FACTS

- COVID-19 emerged in Wuhan city, Hubei Province, China in December 2019.
- The etiology of COVID-19 is SARS-CoV-2, a Betacoronavirus closely related to the known SARS-CoV.
- The intermediate host had not been identified yet.

- The incubation period for the COVID-19 is within 14 days, generally 4-5 days, and is about 3 days for Omicron (B.1.1.159) variant.
- Mild disease: 81%
- Severe cases: 14%
- Critical disease: 5%
- Recognition of the COVID-19 epidemic was important, and the credit goes to Chinese scientists including the late ophthalmologist Dr Li Wenliang, one of the eight physicians who alerted the world of an outbreak of pneumonia of unknown cause. In addition, the web-based international surveillance system for emerging pathogens—ProMED-mail—had reports of cases of undiagnosed pneumonia resembling SARS weeks before the World Health Organization (WHO) reported the epidemic.
- Data on the rate of infection among healthcare workers had received special attention and research showed that HCWs accounted for 3.8% to 19% of all cases.

CONTROVERSIAL ISSUES

The exact origin of the SARS-CoV-2 virus continuous to be debated among the scientific community. Uncertainty surrounds the precise risk of contracting SARS-CoV-2 infection in a health-care setting. Clinical significance of prolonged positive PCR for SARS-COV-2 in patients who are severely ill or immunocompromised and its impact on decisions to discontinue isolation precautions for. The recommendations had used either

transmission-based precautions based on duration of symptoms or based on re-testing using molecular SARS-CoV-2 tests.

SUGGESTED PRACTICE

Table 1: The World Health Organization Infection Control Recommendations

Recommendation	Level of Recommendation	Level of Evidence/certainty
A respirator or a medical mask with gown, gloves, and eye protection – by HCWs caring for a patient with suspected or confirmed COVID-19.	Strong	Low
Respirators may be used in care settings where ventilation is known to be poor or cannot be assessed, or the ventilation system is not properly maintained.	Conditional	Low
Using airborne precautions while performing aerosol-generating procedures (AGPs) and based on a risk assessment, when caring for patients with suspected or confirmed COVID-19.	Conditional	Very low
Adhering to the ventilation rate requirements for health-care facilities in the context of COVID-19.	Strong	Very low
Physical barriers such as glass or plastic windows may be considered for areas	Conditional	Very low

<p>where patients first present, such as screening and triage areas, the registration desk at the emergency department and the pharmacy window.</p>		
---	--	--

It is important to realize and adhere to the routine practice of early identification, triaging suspected patients, and prompt isolation similar to other respiratory viral infection. Source control of infected or suspected patients should include the use of use of respirators or well-fitting facemasks or cloth masks. In healthcare facilities, in the absence of aerosol generating procedures face mask, gloves and aprons are recommended. Respirators (particulate respirators with N95 filters or higher) are recommended in situations where an aerosol generating procedure (AGP) (such as suctioning , intubation, or nebulization therapy). In addition, the use of such respirators are required in case of surgical operations that could increase the risk of transmission in patients with SARS-CoV-2 infection (e.g., aerosols that could be infectious or involve anatomic regions such the respiratory tract, oropharynx, nose and throat, that have higher viral loads). The World Health Organization (WHO) states that health workers who collect nasopharyngeal and oropharyngeal swabs use appropriate PPE (i.e. eye protection, a medical mask, a long-sleeved gown, and gloves). If the specimen is collected with an AGP (e.g. sputum induction), personnel conducting the procedure should wear a particulate respirator at least as protective as a NIOSH certified N95, an EU standard FFP2, or equivalent respirator. During care of such patients, eye protection (such as goggles or a face shield covering the front and sides of the face) must be used.

It is important to keep in mind that the use of gloves does not substitute hand hygiene. Gowns and eye protection should be used as well as hair covers if available. It is preferable to place the patient in a room with negative air pressure, especially during AGP. In low-middle income countries, negative pressure rooms might not be available and thus it is prudent to increase rooms' natural ventilation to the following minimum hourly averaged ventilation rates of 160 l/s/patient (hourly average ventilation rate) for airborne precaution rooms (with a minimum of 80 l/s/patient).

Table 2: Management of Suspected of having COVID-19

- Isolate the patient.
- Place the patient in a private room with negative pressure, especially during an AGP, if possible.
- In low-middle income countries, negative pressure rooms might not be available and thus it is prudent to increase rooms' natural ventilation to the following minimum hourly averaged ventilation rates of 160 l/s/patient (hourly average ventilation rate) for airborne precaution rooms (with a minimum of 80 l/s/patient).
- Wear gloves, a gown, and a medical mask and if an AGPs is to be undertaken, use an N-95 respirator, an EU standard FFP2, or equivalent respirator.
- Some AGPs have been associated with increased risks of transmission of SARS-CoV-2. According to the WHO, these AGPs include tracheal intubation, non-invasive ventilation (e.g. BiPAP, CPAP), tracheotomy, cardiopulmonary

resuscitation, manual ventilation before intubation, bronchoscopy, sputum induction induced by using nebulized hypertonic saline, and autopsy procedures. It remains unclear whether aerosols generated by nebulizer therapy or high-flow oxygen delivery are infectious.

- Perform the AGPs in an adequately ventilated room or a negative pressure room.
- Remove the gown, mask and gloves and discard in the room before leaving.
- Carry out hand hygiene- alcohol based-hand rub (ABHR) or hand washing
- Open the door and come out of the room.
- Carry out hand hygiene.
- Carefully remove the respirator outside the patient's room without contaminating hands.
- Perform hand hygiene after removing gloves, and as indicated, and apply the WHO's "My 5 Moments for Hand Hygiene".
- Limit the number of healthcare workers caring for patient and track them.
- Limit the number of visitors to those who need visitors such as children and critically ill patients.
- Perform bacterial and viral diagnostic studies for community-acquired pneumonia including SARS-CoV-2.
- Supplement oxygen for hypoxemia.
- Use antibacterial agents if secondary community-acquired pneumonia has been diagnosed.
- Use a neuraminidase inhibitor for treatment of influenza, as indicated.

- Symptomatic patients with non-severe disease and at increased risk of complications such as older (≥ 65 years, presence of comorbidities, or immunocompromised): use Nirmatrelvir-ritonavir if no contraindication. Be aware of significant drug-drug interactions. For severe disease and those with hypoxia: use steroid such as dexamethasone.
- For hospitalized patients without hypoxia: use of remdesivir is a reasonable choice.
- Stay updated with the COVID-19 vaccine.
- Have source control and thus those with suspected or confirmed SARS-CoV-2 infection or other respiratory infection (e.g., those with runny nose, cough, sneeze) should have a face mask.
- Maintain a clean and dry environment with daily cleaning with soap and water and use 70% alcohol wipes for surfaces.
- Use 70% alcohol on bedside counters and on medical equipment that can tolerate the disinfectant, such as IV poles, at least daily. Note that chlorine is corrosive and an irritant for the respiratory tract thus making clinical symptoms worse.

SUGGESTED PRACTICE IN UNDER-RESOURCED SETTINGS

Table 3: Management of Suspected COVID-19 Patients

- Isolate the patient and ensure that at least minimum requirements for infection prevention and control are in place as soon as possible.
- Apply standard precautions for all patients.
- Place the patient in adequately ventilated single room.
- Wear gloves, a gown, and regular surgical masks (use an N-95, an EU standard FFP2, or equivalent respirator, especially when performing aerosol generating procedures).
- Just before leaving the room, remove the gown, mask, and gloves in the room.
- Discard in an infectious waste container.
- Perform hand hygiene after removing gloves, and as indicated, and should apply the WHO's "My 5 Moments for Hand Hygiene."
- Limit the number of healthcare workers caring for patient.
- Limit the number of visitors.
- Perform diagnostic studies, if possible, to rule out known causes of community-acquired pneumonia and to rule in SARS-CoV-2.
- Supplement oxygen for hypoxemia.
- Antibacterial agents for community-acquired pneumonia.
- Consider a neuraminidase inhibitor for treatment of influenza, if available.
- For severe disease and those with hypoxia: use steroid such as dexamethasone

- Stay updated with the COVID-19 vaccine.
- Have source control and thus those with suspected or confirmed SARS-CoV-2 infection or other respiratory infection (e.g., those with runny nose, cough, sneeze) should have a face mask.
- Maintain a clean environment. Use 70% alcohol on bedside counters and on medical equipment that can tolerate the disinfectant, such as IV poles, at least daily. Note that chlorine is corrosive and an irritant for the respiratory tract thus making clinical symptoms worse.

Environmental cleaning and disinfection: It is important to ensure proper and frequent cleaning and disinfection of surfaces and the environment. However, cleaning environmental surfaces with water and detergent, and the use of common hospital disinfectants (e.g. sodium hypochlorite) are effective and sufficient.

Table 4: Test-based strategy for Discontinuation of Transmission-Based Precautions

Test-based strategy:

- Results from at least two consecutive respiratory specimens examined with an antigen test or NAAT, taken 48 hours apart, are negative (total of two negative specimens).

Individuals with moderate to severe immunocompromised status:

- They may continue to produce replication-competent virus more than 20 days after the start of symptoms, or more than the date of the first positive viral test if they were asymptomatic during the illness.
- To decide whether Transmission-Based Precautions for these individuals could be stopped, it is advised to use a test-based approach and, if available, confer with an infectious disease specialist.

Table 5: Duration-based strategy for Discontinuation of Transmission-Based Precautions for those who are not moderately to severely immunocompromised

	Mild to moderate illness	Severe to critical illness
Time passed since symptoms first appeared	At least 10 days	At least 10 days and up to 20 days have passed
Since last fever without the use of fever-reducing medications	At least 24 hours	At least 24 hours
Symptoms (e.g., cough, shortness of breath)	Improved	Improved

SUMMARY

The COVID-19 disease had caused a global pandemic since 2020 and the WHO declared the end of the COVID-19 as a public health emergency in May 2023. The disease is caused by SARS-CoV-2. This virus is phylogenetically distinct from previously known human and animal coronaviruses but is closer to the SARS virus. The SARS-CoV-2 virus was first identified in Wuhan city, Hubei, China in December 2019.

REFERENCES

1. <https://promedmail.org/promed-post/?id=20191230.6864153>
2. Centers for Disease Control and Prevention. Interim Infection Prevention and Control Recommendations for Healthcare Personnel During the Coronavirus Disease 2019 (COVID-19) Pandemic. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html>
3. World Health Organization. Infection prevention and control during health care when coronavirus disease (COVID-19) is suspected or confirmed. <https://www.who.int/publications/i/item/WHO-2019-nCoV-IPC-2021.1>
4. European Centers for Disease Control and Prevention. Infection prevention and control and preparedness for COVID-19 in healthcare settings https://www.ecdc.europa.eu/sites/default/files/documents/Infection-prevention-and-control-in-healthcare-settings-COVID-19_6th_update_9_Feb_2021.pdf

5. Infection prevention and control in the context of coronavirus disease (COVID-19): a living guideline, 9 October 2023. Geneva: World Health Organization; 2023 (WHO/2019-nCoV/IPC/guideline/ 2023.3)
6. Tran K, Cimon K, Severn M, Pessoa-Silva CL, Conly J. Aerosol generating procedures and risk of transmission of acute respiratory infections to healthcare workers: a systematic review. PLoS One. 2012;7(4):e35797-e
7. Al-Tawfiq JA, Memish ZA. COVID-19 isolation strategies: What have we learned. Travel Med Infect Dis. 2022 Sep-Oct;49:102416