



Coronaviruses: SARS, MERS, and 2019-nCoV

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Background

Coronaviruses (CoV) are a family of RNA viruses that typically cause mild respiratory disease in humans.¹ However, the 2003 emergence of the severe acute respiratory disease coronavirus (SARS-CoV) demonstrated that CoVs are also capable of causing outbreaks of severe infections in humans.² A second severe CoV, Middle East respiratory syndrome coronavirus (MERS-CoV), emerged in 2012 in Saudi Arabia.³ More recently, a novel coronavirus was identified in Wuhan, China, in December 2019.⁴

The emergence of human coronaviruses, including MERS-CoV and SARS-CoV, is thought to be driven by the spillover of bat-adapted CoVs into an intermediate host. For SARS-CoV, this intermediate host is believed to be palm civets, while camels play that role for MERS-CoV. The existence and identity of an intermediate host for the 2019-nCoV has yet to be determined. Direct transmission of CoVs from bats to people is also theoretically possible.

Epidemiology and Clinical Characteristics

There are 7 coronaviruses known to infect humans.⁵ Of those, only MERS-CoV and SARS-CoV are routinely capable of causing severe disease. The rest are responsible for mild respiratory illnesses like the common cold but can cause severe infections in immunocompromised individuals. The clinical severity of the 2019-nCoV is unknown at this time, although fatal cases have occurred.

SARS-CoV

The only recognized SARS-CoV outbreak began in China in 2002 and spread internationally, most notably to Toronto, Canada. From November 2002 to July 2003, the World Health Organization (WHO) reported 8,437 SARS cases and 813 deaths.⁶ Like other coronaviruses, SARS-CoV is transmitted from person to person through respiratory droplets and close contact.

The incubation period is 4 days (range 1 to 13 days). The main symptoms of SARS are fever, headache, and discomfort. The case fatality risk is approximately 10%.

MERS-CoV

MERS-CoV was first identified in Saudi Arabia in 2012. To date, there have been more than 2,400 cases, mostly in the Middle East.⁷ Individual cases and small clusters continue to be reported in that region. Travel-related MERS cases have also been reported in South Korea, where it caused a significant hospital-based outbreak in 2015, and in the United States, where 2 very mild cases were diagnosed. MERS-CoV is transmitted from person to person via respiratory droplets and close contact.

The incubation period is 5 days (range 2 to 15 days). The main symptoms of MERS are fever, chills, generalized myalgia, cough, shortness of breath, nausea, vomiting, and diarrhea. The case fatality risk is approximately 35%.

Diagnosis and Treatment

Laboratory diagnosis of coronavirus infections relies on nucleic acid-based testing early in the clinical course and serology later on. It is possible to isolate SARS-CoV, MERS-CoV, and other coronaviruses from respiratory secretions, blood, urine, and fecal samples for diagnostic testing. Clinically, coronavirus infections can be diagnosed with respiratory viral panels that are widely commercially available.⁸

Care for coronavirus patients is supportive in nature and may include supplemental oxygen, fluid administration, and, for critically ill patients, being managed in intensive care units and receiving rescue therapies such as extracorporeal membrane oxygenation.

Infection Control Measures

Hospitals have amplified both SARS-CoV and MERS-CoV outbreaks, and superspreading events have been noted.⁹ Consequently, stringent infection control is critical to preventing transmission to healthcare workers and other patients. Droplet precautions (eg, surgical or procedure mask, gown, and gloves) are indicated during the treatment of all coronavirus patients, and such protocols for droplet-spread respiratory viruses are part of hospital infection control practices. Additional respiratory precautions may also be appropriate during aerosol-generating procedures. Healthcare providers should consult the latest CDC or WHO guidance when managing a patient with a suspected SARS, MERS, or novel coronavirus infection.

Medical Countermeasures

Currently, there are no licensed vaccines or therapeutic agents (ie, antivirals and monoclonal antibodies) indicated for coronavirus prevention or treatment. However, researchers are working to develop medical countermeasures. Several vaccine candidates for both SARS and MERS coronaviruses are in early clinical trials. Remdesivir, a broad-spectrum antiviral, has recently been evaluated in an animal model and may be effective in treating MERS and other coronavirus infections.¹⁰

References

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