

Coronavirus Infections: SARS and MERS

WWW.RN.ORG®

Reviewed November 2023, Expires November 2025
Provider Information and Specifics available on our Website
Unauthorized Distribution Prohibited
©2023 RN.ORG®, S.A., RN.ORG®, LLC
Wanda Lockwood, RN, BA, MA



Purpose

The purpose of this course is to provide current information about coronaviruses, including SARS and MERS, and the signs and symptoms, complications, transmission precautions, diagnosis, and treatment.

Goals

Upon completion of this course, the nurse should be able to

- Describe the coronavirus, including appearance.
- Discuss the history of severe coronavirus infections.
- Describe the role that wet markets have in spreading zoonotic diseases to humans.
- Describe typical signs and symptoms of the two stages of SARS.
- Explain the 3 types of transmission prevention required for SARS and other severe coronavirus infections.
- Discuss transmission of MERS.

Introduction

Coronaviruses are not new. They have been around for aeons, infecting humans with mild upper respiratory infections, such as the common cold. Animals infected with coronaviruses may develop respiratory, gastrointestinal, liver and neurologic disease. Therefore, when these viruses

jump from animal species to humans, severe illness and the risk of pandemics can result.

Coronaviruses are a group of viruses and are so named because of their shape, which is round with a halo of proteins spiking from the surface. Coronaviruses are composed of RNA, and each variety can be very distinct from others. There are four primary types of coronaviruses: alpha, beta, delta, and gamma. Four varieties (229E, NL63, OC43, and HKU1) cause up to 30% of common colds.



Coronaviruses first came to the attention of the public in 2002. In November 2002, the first case of a new type of coronavirus infection occurred in Guangdong Province, China, resulting in the death of the patient, followed by more infections, but the Chinese government failed to report the outbreak to the WHO or to acknowledge that an outbreak was occurring, even though the WHO requested information in December based on internet reports of a "flu outbreak." When, several months later, the WHO was able to take action, 500 people had died and over 2000 cases had occurred worldwide.

This new coronavirus infection was referred to as severe acute respiratory syndrome (SARS) and was a documented instance of a coronavirus jumping from wildlife to humans. By April, the CDC was able to publish the sequence of the virus.

The CDC issued a number of travel alerts (Toronto, Singapore, Toronto, China, Taiwan, Hong Kong (areas with outbreaks) in order to reduce risk to the United States. By July 2003, the outbreak was contained, but SARS had spread to 17 countries with 8096 identified cases and 774 deaths, a 9.6% mortality rate. Only 8 people in the United States became infected and all survived. It is estimated that the SARS outbreak cost the world about \$40 billion dollars.

Subsequently, SARS has been followed by outbreaks of MERS and COVID-19, the coronavirus infection now ravaging the world.

How are wet markets implicated in transmission of coronaviruses in China?



Coronaviruses are zoonotic diseases (those that spread between animals and humans). In China, both SARS and the Wuhan coronavirus have been linked to wet markets that sell fruits, vegetables, spices, live animals (pigs, chicken, ducks, civets, rats, beavers,

porcupines) butchered meat, dogs, rabbits, fish, shellfish and snakes. The Chinese, especially, like to purchase live animals and have a penchant for wild animals, which many believe can cure disease and improve male potency.

The markets that sell this wide range of food products are called wet markets because workers slosh water about the floor to wash away the inevitable feces and urine, resulting in a literal soup of pathogens. Whether people become infected from contact with the animals or ingestion is not always clear. The SARS coronavirus infection was finally traced to civets (cat-like mammals), which had become infected from bats.

Severe Acute Respiratory Syndrome (SARS-CoV)

The public became generally aware of the SARS, outbreak in February 2003 when an American (Johnny Chen) traveling from China to Singapore became seriously ill on the plane and was hospitalized in Hanoi, Vietnam, where he died. Subsequently, a number of staff members at the hospital became ill despite using standard precautions in caring for Chen. In response to the severity of the illnesses, the WHO issued a global alert in March 2003 and the CDC issued a health alert. However, the disease continued to spread.

The SARS-associated coronavirus (SARS-CoV) is from the Coronaviridae family and is spread through close contact with an infected animal or person. Civets infected by bats are thought to have initially spread the disease to a human. Person-to-person transmission is primarily through respiratory droplets (sneeze, cough), usually no more than a 3-foot distance. However, the disease can also spread through contact with contaminated surfaces or

exchange of body fluids and airborne transmission. SARS appears to be easily transmitted with close contact. It is also possible that fecal-oral transmission can occur.

The incubation period for SARS is generally 2 to 7 days although this may extend to 10 to 14 days in rare cases. People with the infection are contagious when they are symptomatic.

Signs and symptoms

SARS typically begins with mild to moderate flu-like symptoms, but some patients progress to pneumonia and respiratory failure. Some may be asymptomatic as well.

Stage 1	This upper-respiratory stage usually lasts from 3 to 7 days during which the patient may have fever ($>100.4^{\circ}\text{F}/38^{\circ}\text{C}$), chills, headaches, fatigue, general malaise, myalgias, anorexia. Some may complain of sore throat, nausea and vomiting, dizziness, diarrhea (occurs in 10 to 20%), coryza, and increased sputum production. Delirium may occur in older adults.
Stage 2:	This lower respiratory stage is characterized by dry, non-productive cough, increasing dyspnea and hypoxemia, and respiratory failure requiring mechanical ventilation (10 to 20%) in severe cases. The patient's condition may worsen rapidly.

Complications

Between about 25% and 70% of those infected develop hepatitis, resulting in worse outcomes. Some patients may develop a severe neurological syndrome. Most patients develop pneumonia, and pneumonia is the most common cause of death associated with SARS.

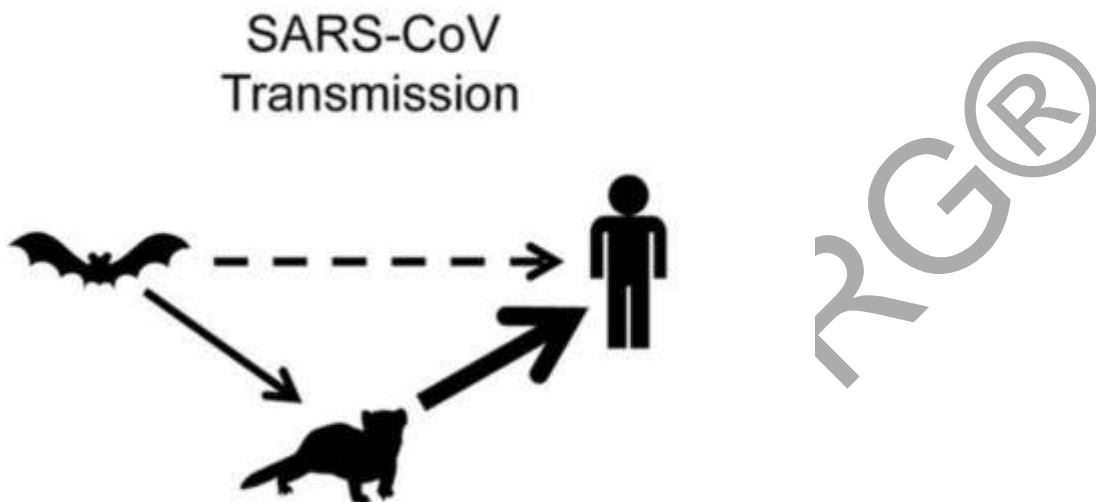
Diagnosis

If a patient enters stage 2, the chest x-ray may appear normal for the first 7 days or more but eventually patchy interstitial infiltrates appear if the patient develops pneumonia. SARS pneumonia results in diffuse alveolar damage.

Various tests are typically carried out, including blood cultures, sputum Gram stain, viral respiratory pathogen tests, antibody tests, PCR, and viral culture/isolation tests. CDC provides guidance regarding confirming diagnosis. Laboratory findings associated with SARS include elevation in creatinine kinase, lactate dehydrogenase, alanine aminotransferase, and hepatic transaminase. Patients may exhibit mild hyponatremia and

hypokalemia as well as mild lymphopenia, leukopenia, and thrombocytopenia.

Transmission and prevention



Healthcare providers and those in contact with infected patients should utilize contact, droplet, and airborne precautions with N95 respirators. Patients are advised to avoid contact with others and to remain at home until 10 days after the fever is resolved and no respiratory symptoms are present. SARS does not appear to be contagious during the incubation period. Gloves should be applied for any direct touching of a patient with SARS, and patients and those in contact with the patients should wear face masks.

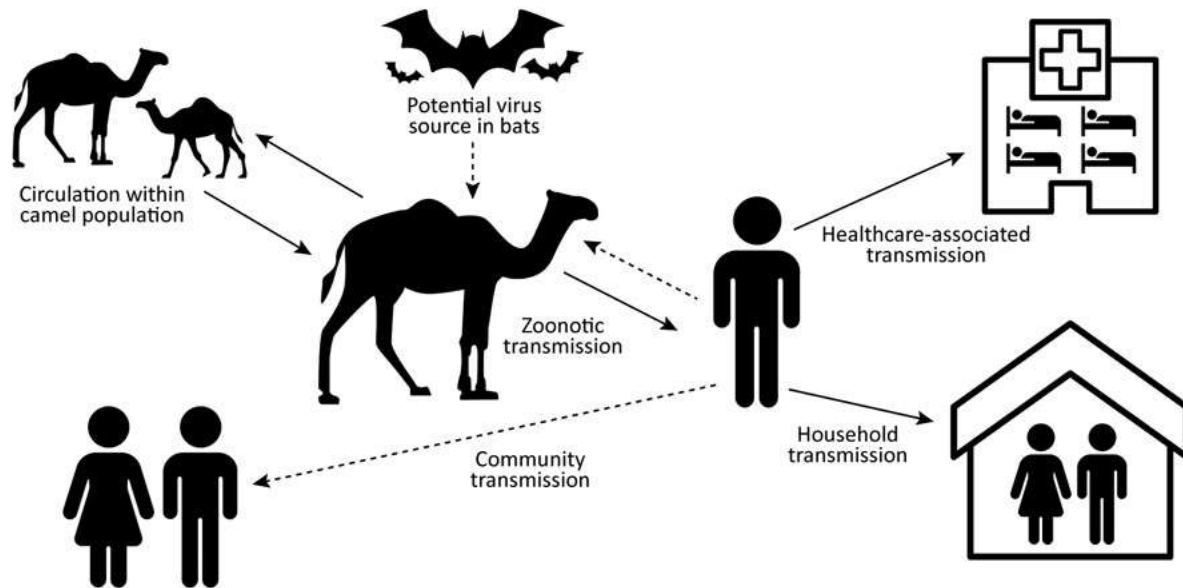
The basic reproductive rate (R_0) of SARS (the number of cases of the disease that typically result from exposure to an infected person) is 2 to 4 although instituting effective precautions can lower this rate considerably.

Treatment

There is no definitive treatment protocol for SARS, so treatment is usually carried out with consultation from state public health officials and the CDC. Antibiotics are not recommended because they are ineffective for viral infections. Various treatments have been tried, including steroids, which may reduce lung injury but increase risk of mortality.

Treatment has often included an antiviral agent (typically with a steroid) although ribavirin (the most commonly used) appears to have no effect. A high-affinity human monoclonal antibody (huMab) has shown promise in animal studies. While vaccines are being studied, none are available at this time.

Middle East Respiratory Syndrome (MERS)



MERS was first reported in Saudi Arabia in 2012 but has subsequently been found in 27 countries, including the United States with 2 imported cases in 2014 (Indiana and Florida). Both patients had traveled from Saudi Arabia to the United States and both recovered. MERS is believed to have spread from live camels, which had become infected by bats, to humans through association rather than ingestion.

By November 2019, 2494 cases of MERS worldwide had been confirmed with 780 deaths, a death rate of 34.4%. Outbreaks associated with healthcare have occurred in Saudi Arabia, United Arab Emirates, and South Korea.

Incubation period

The incubation period is typically 5 to 6 days although it can range from 2 to 14 days. Median time from onset of symptoms to hospitalization is 4 days and median time from onset of severe symptoms to admission to ICU is 5 days. Death usually occurs within 12 days.

Signs and symptoms

Some patient may be asymptomatic while others may exhibit a range of respiratory symptoms. Mild fever, nonproductive cough, headache, and dyspnea are common as is pneumonia, which can result in the need for

mechanical ventilation. Some may develop diarrhea. Severe disease is most common in those with immunocompromise, chronic disease, and older age.

Complications

The most common complications are acute respiratory failure, ARDS, refractory hypoxemia and extrapulmonary disorders, such as acute kidney injury, hypotension, hepatitis, and septic shock.

Diagnosis

Patients should be evaluated for MERS if they have signs and symptoms associated with the disease and a history of travel in or near the Arabian Peninsula within 14 days of onset of symptoms, close contact with a symptomatic traveler from that area, or a history of being in a healthcare facility in or near the Arabian Peninsula within 14 days, or close contact with a confirmed MERS patient.

Testing is guided by the CDC, which recommends multiple specimens from upper and lower respiratory tract for MERS rRT-PCR assay and serologic testing. Imaging may show unilateral/bilateral patches of densities or opacities, interstitial infiltrates, consolidation, and pleural effusions.

Transmission and prevention

Dromedary camels have been found to harbor the same coronavirus as that infecting humans, suggesting that animal-to-human transmission can occur. Additionally, human-to-human transmission can occur with close contact. Healthcare providers and those in close contact with infected patients should adhere to standard, contact, and airborne precautions.

Currently, most cases occur in the Middle East (80% in Saudi Arabia) or with travelers who were infected in the Middle East. Preventive measures include avoiding contact with camels, drinking of raw camel milk/urine, or eating meat that has not been properly cooked.

Treatment

No specific treatment is currently available, so supportive care (hydration, analgesics, antipyretics) is recommended. Antibiotics are ineffective unless a superinfection, such as sepsis, occurs. Antiviral medications do not appear to be effective. Other treatment may depend on the severity of illness but may include mechanical ventilation, renal replacement therapy, and vasopressors.

Conclusion

For years, public health officials have warned that another pandemic could sweep the world and result in millions of deaths, such as the 1919 Spanish

flu that killed about 50 million people and HIV/AIDS that killed 25 million. While antibiotic resistant bacteria certainly are a concern, viruses have posed the greatest threats, including Ebola virus outbreaks in Africa and the coronavirus outbreaks in China and the Middle East.

It is increasingly difficult to confine an outbreak to a small area because of international travel and commerce. When one outbreak, such as SARS, subsides, another one appears, such as MERS and the more recent coronavirus—COVID-19. COVID-19 has become a pandemic that has killed thousands of people throughout the world and continues to pose a serious health threat.

References

- CDC. (2019, August 2). Middle East Respiratory Syndrome (MERS). *CDC*. Retrieved from <https://www.cdc.gov/coronavirus/mers/index.html>
- CDC SARS response timeline. (2013, April 26). *CDC*. Retrieved from <https://www.cdc.gov/about/history/sars/timeline.htm>
- CDC. (2017, December 6). Severe acute respiratory syndrome (SARS). *CDC*. Retrieved from <https://www.cdc.gov/sars/index.html>
- Cennimo, D.J., (2019, March 13). Severe acute respiratory syndrome. *Medscape*. Retrieved from <https://emedicine.medscape.com/article/237755-overview>
- Gompf, S. G. (2019, May 10). Middle East Respiratory Syndrome (MERS) Treatment & Management. *Medscape*. Retrieved from <https://emedicine.medscape.com/article/2218969-treatment>
- WHO. (2021). Middle East respiratory syndrome coronavirus (MERS-CoV). *WHO*. Retrieved from <https://www.who.int/emergencies/mers-cov/en/>

