INTERNATIONAL SOCIETY FOR INFECTIOUS DISEASES

GUIDE TO INFECTION CONTROL IN THE HOSPITAL

CHAPTER 54

Middle East Respiratory Syndrome Coronavirus

Author
Ziad .A. Memish, MD, FRCPC, FACP

Chapter Editor
Michael Stevens, MD, MPH

Topic Outline

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KEY ISSUE

In the summer of 2012 a novel coronavirus emerged in Saudi Arabia and has spread to other portions of the Middle East and globally affecting as of January 2018 a total 2123 human cases from 27 countries with 740 deaths (35%). More than 80% of the reported cases to date have originated from the Arabian Peninsula; mainly from Saudi Arabia, and most cases diagnosed outside the Middle East can be traced to patients who travelled from the region. The largest outbreak outside of the Arabian Peninsula occurred in South Korea in 2015 where a returning traveler from the MEA (Middle East and Africa) infected 186 patients and lead to the death of 36 patients (19%); this was a much lower mortality rate than the global reported mortality of 35%. The causative virus was eventually identified as lineage 2C *Betacoronavirus* and eventually named Middle East Respiratory Syndrome coronavirus (MERS-CoV). MERS-CoV is a zoonotic disease transmitted to humans from infected dromedary single-humped camels. The original source of the virus remains unknown, but evidence points towards a bat source which infects dromedary camels which is now proven to be the major animal reservoir host for MERS-CoV. MERS-CoV is transmitted among patients through droplet & close contact and through airborne during aerosol generating procedures. Lessons learned from the SARS epidemic were applied in the early management of MERS-CoV outbreak.

KNOWN FACTS

- The first MERS-CoV case emerged from Bisha in Saudi Arabia in June 2012, and it was announced to the world first through the web-based international surveillance system for emerging pathogens —ProMED-mail— in September 2012. In retrospect, the CDC tested respiratory samples collected in March-April 2012 from an outbreak of severe

respiratory infection among healthcare workers (HCWs) in the city of Zarqa, Jordan, and identified MERS-CoV as the etiological agent.

- The incubation period for MERS is approximately 5 days (range, 2-15 days).
- Patients infected with MERS-CoV have varied clinical presentations ranging from completely asymptomatic or mild respiratory symptoms to severe disease with bilateral pneumonia and multiorgan failure.
- The MERS-CoV virus can cause sporadic cases, small family and household clusters, and large healthcare facility (HCF) outbreaks with superspreading events very similar to the SARS virus.
- Diagnosis of MERS-CoV relies on RT-PCR of respiratory samples. The yield is much higher with samples collected from the lower respiratory tract. Lower viral titers can be detected in the blood, urine, and stool of some patients. Other laboratory results include lymphocytopenia, thrombocytopenia, elevated serum creatinine, lactate dehydrogenase, alanine, and aspartate aminotransferase.
- The sequence analysis of MERS-CoV virus from different clusters over time have not shown evidence of mutation which is evidence to the lack of virus adaptation to human infection.
- To date there are no effective vaccine or therapeutic agents approved for MERS-CoV and treatment is purely supportive. Randomized controlled trials on specific therapeutic agents, monoclonal antibodies, immunotherapy with convalescent patient plasma and MERS-CoV-specific antibodies are needed to find an effective therapy.
- To date, females constitute 2/3 of the patients affected with MERS-CoV, but the disease severity and mortality has been similar regardless of gender. This difference in gender predisposition is mostly related to cultural exposure of males to the camels in the field. Primary cases in reported outbreaks with higher viral loads, patients older than 50 years and patients with comorbidities (diabetes, chronic renal failure, chronic lung disease, and immunosuppression) tend to have more severe disease with higher mortality.

- Healthcare associated outbreaks have been the key concern with this virus due to:

1. The difficulties in early identification and isolation of affected patients.
2. Crowding of hospital emergency rooms
3. Prolonged shedding of the virus in infected patients (lasting for 3-4 weeks).
4. Poor application of infection control standards in HCFs.

- MERS-CoV is an emerging new coronavirus, with less human to human transmission (with an estimated R0 of less than 0.7) but carrying a higher mortality than SARS.

SUGGESTED PRACTICE

- Although the original source of the virus is community transmission from camels or contact with infected MERS-CoV patients, most of the transmission/outbreaks happen in HCFs due to crowding and poor application of infection control practices (early identification and proper isolation of index patients).
- For the control of MERS-CoV in any country, two strategies must be applied simultaneously:
    1. C**ommunity level**. These will be focused on public education about the disease, its symptoms, known source and preventive strategies. The key is to focus on preventing risky contact with the known animal reservoir (camels) by avoiding exposure of high risk individuals (diabetics, patients with chronic renal failure, chronic lung disease and immunosuppression) to camels and not drinking raw camel milk or using camel urine or eating camel meat unless it is well-cooked. Generally, the public should employ simple common sense hygienic measures when in contact with camels (like washing hands after handling camels and avoiding contact with sick camels).
    2. **Healthcare facility level**. Since differentiating patients with MERS-CoV from patients presenting with respiratory infection due to other

viral etiologies is not possible by history, clinical exam, and simple diagnostic testing, managing all patients with respiratory symptoms with strict application of droplet and contact precautions is a must in endemic countries.

- Some of the key similarities between SARS and MERS are: they are both caused by novel coronaviruses; they are zoonotic in nature; their original source is thought to be bats; they are both transmitted preferentially in HCFs; they both have no approved therapeutic agents or preventative vaccines; and both are controlled in HCFs with strict application of infection control practices. The major difference to date has been the higher reported mortality of MERS-CoV affected patients when compared to SARS (35% vs. 10%) and the slower spread of cases on a national and global level.
- The strict application of contact and airborne isolation in HCFs catering for patients suspected to have MERS-CoV is essential to ensure early detection and proper isolation of patients suspected to have MERS-CoV. Wearing of face masks, preferably N-95 with high filtering ability, is the most important part of infection control protection of healthcare workers. Hand hygiene is also very important for infection control. Proper use of gloves and washing hands after removing the gloves are essential. Gowns and eye protection should be used, and hair covers and shoe covers used if available. If possible, place the patient in a room with negative air pressure.

Table 54.1 Management of Suspected MERS

- Isolate the patient.
- Place the patient in a private room with negative pressure, if possible.
- Wear gloves, a gown, masks (N-95), and eye protection (with face shield, if available, rather than goggles).
- Just before leaving the room, remove the gown and top set of gloves in the room.
- Wash hands carefully after removing gloves.

- 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 MERS-CoV.
- Maintain a clean environment.
- Use chlorine solutions on bedside counters and on medical equipment that can tolerate the disinfectant, such as IV poles, at least daily.
- Supplemental oxygen for hypoxemia.
- Antibacterial agents for community-acquired pneumonia.

Consider a neuraminidase inhibitor for treatment of influenza, if available.

SUGGESTED PRACTICE IN UNDER-RESOURCED SETTINGS

- In the resource constrained setting the use of airborne isolation might be difficult; when airborne isolation is not available private rooms with proper ventilation should be used. If N95 masks are in limited supply, surgical masks could be used (and N95 mask use restricted to times where aerosol generating procedures are being performed).
- Hand hygiene continues to be a very important infection control practice to be applied on all patients. The usual practice of washing hands after removing the gloves is essential.
- Gowns and eye protection should be used; hair covers and shoe covers should be used if available.
- Whenever healthcare workers are exposed to initially non-isolated patients, the employee should be furloughed to their homes for 10 days and have 2 negative MERS-CoV samples before returning to work in the hospital.

SUMMARY

MERS is a new and formidable epidemic that is challenging infection control programs. Although close contact is necessary for transmission most of the time, the possibility exists for coincident transmission via the airborne route and fomites. To contain this novel coronavirus, there is no room for error or relaxation of the highest standards of all features of infection control. Continuing high caliber, multicenter, collaborative, randomized, controlled research will generate solid evidence to help resolve our knowledge gaps about the disease and its pathogenesis to ensure rapid development of effective therapeutics and preventive strategies.

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