Middle East Respiratory Syndrome

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Etiological agent: MERS-CoV (Middle East Respiratory Syndrome Corona Virus)
Corona Viruses are so named for the crown of spikes that allows them to attach to host.
MERS is an enveloped, RNA , beta coronavirus. (3)

Transmission: Similar to other Corona viruses (like the common cold) -direct contact with droplets from infected patients, i.e. coughing or sneezing, contact with infected instruments. (1) Human to human transmission is not well understood. This is expected to change as further research is completed on this new virus. (3)

Reservoir: Dromedary Camel (2) However, MERS-CoV has been shown to grow in cell lines from several species, including Egyptian bats which were initially suspected as the main reservoir. The form of Middle East Respiratory Syndrome that has been isolated from infected patients is most similar to that in camels. Human interaction with Dromedary camels is common in the Kingdom of Saudi Arabia. Camels are kept on farms while their milk and meat are regularly consumed by humans.

Key tests for identification For PCR testing, the World Health Organization recommends obtaining samples from the lower respiratory tract as this area has the highest viral loads.

Recommended testing starts with an upE RT-PCR (Real time Reverse Transcriptase Polymerase chain Reaction that targets elements upstream of the E gene) and if positive confirm with ORF (Open Reading Frame) 1A assay or RdRp or N gene sequence assay for confirmation. If both an upE and secondary assay are positive it is considered a confirmed case. Positive results should be reported to the World Health Organization and local health authorities as appropriate. (4)

Historical information to include when and who isolated the microbe and any significance of its name

Middle East Respiratory Syndrome Coronavirus (MERS-CoV), formerly known as novel coronavirus (NCoV), is a beta coronavirus which has not been identified in humans before and is different from any coronaviruses (including SARS-coronavirus) that have been found in humans or animals. The index case was a patient in Jeddah, Saudi Arabia, who was hospitalized with pneumonia in June 2012. The patient developed acute respiratory distress syndrome along with acute kidney injury and died; the virus that was eventually named MERS-CoV was isolated from his sputum.

Egyptian virologist Dr. Ali Mohamed Zaki isolated and identified MERS after routine diagnostics failed to identify the causative agent in the index patient. Ron Fouchier, a
leading virologist at the Erasmus Medical Center in Rotterdam, the Netherlands, sequenced the virus; after having been sent a virus sample sent by Zaki. (5)

**Signs and symptoms of the disease**

The Corona viruses include the common cold and the South Asian Respiratory Syndrome (SARS). MERS symptoms mimic those of the ‘common cold’ but are much more pronounced. The symptoms include coughing, fever, pneumonia, and shortness of breath. Suspected cases of MERS usually present with respiratory distress. If the patient has had contact with a confirmed MERS-CoV patient or has recently traveled from Middle Eastern country, laboratory testing for MERS-CoV is warranted. The maximum incubation period is 14 days. (4)

Elderly and other people with compromised immune systems are more likely to require hospitalization.

**Microbial virulence mechanisms contributing to the disease process**

MERS is an RNA virus that bonds to the Dipeptidal peptidase 4 protein receptor in respiratory cells. This protein receptor is found on non-ciliated bronchial epithelial cells in the lungs. MERS-CoV is the first C lineage β coronavirus known to infect humans. This receptor is distinctive from the SARS-CoV receptor. (6)

**Control or treatment for the disease**

Given the high likelihood of mutation by the MERS virus, as other coronaviruses have, virologists suggest concentrating on localized infection control measures. In Middle Eastern countries where people are in contact with the reservoir camels and in those hospitals where patients with respiratory illness convalesce, those measures might prove most effective in curtailing the spread of the virus than a vaccine that will be many years in development if it comes at all.(7)

Scientists working through the National Institutes of Health wrote a report that suggested a combination of two licensed antiviral drugs reduces MERS virus replication and improves clinical outcome in a recently developed monkey model of Middle East respiratory syndrome coronavirus (MERS-CoV). This study suggests that a combination of ribavirin and interferon-alpha 2b stops MERS-CoV from replicating in cell culture. Both antivirals are routinely used together to treat other viral diseases, including hepatitis C. This treatment is expected to begin to be used in treatment of humans in due course.(8)

**Prevention, particularly current research about a vaccine or other means of control/prevention**

Although most treatment for MERS involves palliative and supportive care for infected patients, scientists are beginning to research treatment.
A research group based at Harvard's Dana-Farber Cancer Institute, along with scientists from the University of North Carolina at Chapel Hill, have used a library of human antibodies created and maintained by Dana-Farber to look for those that could be used against MERS-CoV. So far they have found seven MERS-specific neutralizing antibodies, including one labeled 3B11 that they wrote is a ‘lead candidate for further research.’ Additional tests were performed to see how the virus evolves after exposure to the neutralizing antibodies. “They found that mutations that allowed the virus to "escape" the antibodies weakened the virus' ability to replicate.” (9) This could explain the cases of human to human transmission of MERS-CoV that seem to be less virulent than those traced to a camel source.

Vaccine development

Developing a vaccine for a Corona virus that has some ability to mutate is a difficult scientific endeavor. Scientists at Maryland University and Gaithersburg biotech Novavax announced in May 2014 that they had developed a vaccine for combating MERS coronavirus. And that it had succeeded in stopping infection in laboratory studies. According to Dr Gregory Glenn the vaccine works by ‘blocking attachment if the antibody to the human cell.(10) Further testing of this vaccine and other developments may lead to a human vaccine in many years.

In the meanwhile a team of Colorado State University scientists have studied the manner in which the MERS virus developed in the camel respiratory system and how they shed the virus through their nostrils. This research is focusing on a way to prevent the transmission of the virus to humans. (11) If the camels could be vaccinated for MERS, then a human vaccine would be unnecessary as humans are not a reservoir for this virus.

Current cases or outbreaks, both globally and locally

Since its discovery in the summer of 2012, MERS has made headlines for its novelty and similarity to the SARS virus that was a cause of major panic in 2002-3. The majority of MERS infections have been found in the Kingdom of Saudi Arabia. As of March 2015 a total of 1082 cases of MERS have been diagnosed worldwide. 439 deaths have occurred. It is expected that there will be another spike in the prevalence of cases in the spring of 2015 as there have been in previous years. This coincides with camel weaning season when those animals have large viral load. (12)

Hospital workers in the Kingdom of Saudi Arabia are at higher risk for developing this disease because of poor containment practice and bureaucratic covering up that occurred in that country. In April 2013, the Saudi Health Minister was fired after more than 100 cases of MERS-CoV were found to have been mis-reported (13) In Saudi Arabia, the median age of persons with confirmed MERS-CoV infection is 50 years. The male-to-female ratio is 1.6 to 1.0. The lower prevalence among females is thought to be due to headscarfs worn by Saudi women being a physical barrier to transmission. (14)
Outbreak originated in the Arabian Peninsula in Sept 2012. The few cases in Europe and US have been diagnosed in people who recently traveled from affected countries. The two cases in the United States to date:
1. A man in Munster, Illinois who in April 2014 had just returned from Saudi Arabia where as a health care worker, he came into contact with MERS confirmed patients. The patient recovered.
2. Another healthcare worker, also recently traveled from Saudi Arabia was admitted to hospital in Orlando, FL. Although initial tests were negative further investigation did confirm MERS. (7)

References


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