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Middle East Respiratory Syndrome Coronavirus: A Review

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By
Student

Hassan Kadhim Thamir
Supervised by

Adviser
Assistant lecturer
Khetam Qaid Mayea

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

فَتَعَلَى اللَّهِ الْمَلِكُ الْحَقُّ وَلَا تَعْجَلْ بِالْقُرْآنِ مِنْ قَبْلِ أَنْ يُقْضَىٰ
إِلَيْكَ وَحْيُهُ، وَقُلْ رَبِّ زِدْنِي عِلْمًا ﴿١١٤﴾

صَدَقَ اللَّهُ الْعَظِيمُ،

من سورة طه

DEDICATION

Dedicate this search to

- My parents .
- All members of my family .
- All my teachers .
- For my doctor Dr. Khetam Qaid Mayea
- Anyone who helped me in this research .

Certificate of Supervisor

I certify that the project entitled Hassan Kadhim Thamir was prepared by **Middle East Respiratory Syndrome Coronavirus: A Review** under my supervision at the College of Veterinary Medicine / University of Al-Qadissiya for the year 2017 - 2018.

Supervisor

Assistant lecturer

Khetam Qaid Mayea

Dept. of zoonotic disease

Coll. Of Vet.Med./ Univ. of Al-Qadissiya.

-- / -- / 2018

Certificate of Department

We certify that Hassan Kadhim Thamir has finished his/her Graduation Project entitled (**Middle East Respiratory Syndrome Coronavirus: A Review**) and candidate it for debating.

Instructor

Dr. Muthanna H. Hussain

/ / 2018

Head of Dept of Int. and Prev. Med.

Dr. Muthanna H. Hussain

/ / 2018

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Summary

Covs are common human pathogens affecting children and adults worldwide with most individuals becoming infected in the first few years of life . The symptoms of most coronaviruses are similar to any other upper-respiratory infection . There is no treatment for the disease and transmission contender camel trans for human , not all other potential sources of transmission have been ruled out

Introduction

The first cases of corona virus infection in Saudi Arabia, specifically Jeddah, were reported on June 13, 2012; after this outbreak, corona virus continued to spread overseas to many countries in Asia, Africa, Europe, and America [33, 34, 35, 36]. During this outbreak, most cases occurred in Middle Eastern countries, including those in the Gulf region (Saudi Arabia, Qatar, United Arab Emirates, Oman, Bahrain, Kuwait, and Iraq), as well as Jordan, Syria, Lebanon, Palestine, and Egypt. These countries were considered to be at high risk for corona virus infection according to the European Centre for Disease Prevention and Control (ECDC). Thus, any person arriving from any of these countries should be screened at the airport before entering, particularly after several cases of infection were reported in European countries, including France and the United Kingdom [37, 38, 39]. CoVs are common human pathogens affecting children and adults worldwide with most individuals becoming infected in the first few years of life [1]. And their role in enteric infections is less clear, even though CoVs-like particles have been seen by electron microscopy in stool samples from patients with diarrhea, they have been also found in healthy individuals [2]. Generally, CoVs have been displayed marked winter seasonality between the months of December and April and were not detected in summer months, which are comparable to the pattern, seen with influenza viruses [3], with a short incubation time [4], in temperate climates [5].

Corona virus

Corona virus is a single-stranded, enveloped RNA virus 1 that is spherical or pleomorphic in shape with bear's club-shaped glycoprotein projections. There are subtypes of corona virus, alpha corona virus, beta corona virus, gamma corona virus, and delta corona virus, and each subtype has many serotypes. For example, OC43-like and 229E-like have been shown to affect humans, whereas the other types mainly affect animals. Corona viruses are transmitted via airborne zoonotic droplets, and viral replication occurs in the ciliated epithelium, resulting in cellular damage and inflammatory reactions at the site of infection [6, 7]. In addition to humans, corona viruses are also found in bats, whales, pigs, birds, cats, dogs, and mice [8, 9, 10, 11, 12].

Classification

- *Family:* Coronaviridae; *Subfamily:* Coronavirinae; *Genus:* Betacoronavirus; *Species:* Not established
- Virion morphology and size: Enveloped, spherical particles, 118-136 nm in diameter, with spikes that project 16-21 nm from the virion envelope. A flexible helical nucleocapsid is present that forms coils that fold back on themselves.
- Nucleic acid: monopartite, positive-sense, single-stranded, polyadenylated and capped RNA, 26-32 kb in length, the largest of all RNA genomes
- Physicochemical properties: Sensitive to detergents and organic chemicals such as ether and chloroform. pH and temperature stabilities are variable among the coronaviruses but most are sensitive to heat, nonionic detergents, formaldehyde, oxidizing agents and UV irradiation.



Common Symptoms of Coronavirus

The symptoms of most coronaviruses are similar to any other upper-respiratory infection, including runny nose, coughing, sore throat, and sometimes a fever. In most cases, you won't know whether you have a coronavirus or a different cold-causing virus, such as rhinovirus. But if a coronavirus infection spreads to the lower respiratory tract (windpipe and lungs), it can cause pneumonia, especially in older people, people with heart disease, or people with weakened immune systems (3)

Primary Disease Symptoms:

- All patients have acute respiratory symptoms, whereas several patients also may have accompanying gastrointestinal symptoms such as abdominal pain and diarrhea.

Transmission by Blood Transfusion:

- Not reported

Vector and Reservoir Involved:

- None known

Incubation Period:

- Generally less than one week, but may be as long as 14 days

Severity of Clinical Disease:

- Severe

Mortality:

- Globally, as of August 13, 2013, 91 laboratory-confirmed cases of infection with MERS-CoV, including 47 deaths, have been reported to WHO (case-fatality rate: 50%).

Chronic Carriage:

- No evidence for chronicity.

Treatment Available/Efficacious:

- Supportive care with hospitalization in an intensive care unit. Healthcare workers caring for patients should exercise standard precautions including contact and airborne precautions.

Agent-Specific Screening Question(s):

- No specific question is in use.
- Not indicated because transfusion transmission has not been demonstrated
- Neither the CDC nor the FDA has recommended a question. If necessary the prospective donors could be asked if they have been in close contact with a symptomatic traveler who has developed fever and acute respiratory illness within 14 days of traveling from the Arabian Peninsula or neighboring countries.

Pathogen Reduction Efficacy for Plasma Derivatives:

- Multiple pathogen reduction steps used in the fractionation process have been shown to be robust in the removal of enveloped viruses.

Other Prevention Measures:

- Contact and airborne transmission precautions, in addition to standard precautions. Regard all specimens as potentially infectious.

MERS-CoV and bats

Corona virus as known to be a zoonotic virus; however, the MERS-CoV is a novel virus, and whether zoonotic transmission occurs is not clear yet. International studies carried out from 2012 to 2014 in Mexico, European countries (i.e., Germany, Ukraine, the Netherlands, and Romania), Ghana, and South Africa have examined whether bats may be carriers of MERS-CoV. These studies have tested bats mainly for the 329-bp fragment of RdRp using blood, fecal, and oral. The bat species that were tested in these studies included *Pipistrellus pipistrellus*, *P. nathusii*, *P. pygmaeus*, *Nycteris*, and *Neoromicia azuensis*, and 5.3–24.9% were found to be positive for MERS-CoV, with most positive results (> 70%) being identified in fecal samples with high viral loads [14, 15, 16, 17]. Thus, it may be possible for transmission to occur via bats; however, in Saudi Arabia, the species of bats that patients may have come in contact with are different from those tested, including *Rhinopomahardwickii*, *Rhinopomamicrophyllum*, *Taphozous perforatus*, *P. kuhlii*, *Eptesicus bottae*, *Eidolon helvum*, and *Rosettusaegyptiacus*. Thus, although there was a positive association between bats and corona virus infection, there was no association between bats and MERS-CoV. Therefore, these data have suggested that MERS-CoV is not transmitted through bats [18, 19, 20, 21].

MERS-CoV and camels

Researchers have also examined whether camels may be linked to the outbreak of MERS-CoV in Saudi Arabia. Studies have been carried out in many Middle Eastern countries, including Saudi Arabia, Qatar, Egypt, United Arab Emirates, and Oman, using samples from lung, nasal, and rectal swabs. Positivity for MERS-CoV by RT-PCR for the RdRp was observed in 1.6–61.5% of samples, mostly lung and nasal swabs. Analyses using anti-MERS-CoV antibodies have shown that 98–100% of camels are positive for MERS-CoV; consistent with this, the incidence of MERS-CoV in humans is 15 times higher in camel shepherds and 23 times higher in slaughterhouse workers than in the general population. Therefore, these data supported that the main route of transmission from camels to humans is through the respiratory system [22, 23, 24, 25, 26].

Management and vaccination

The main treatment strategy for typical corona virus infection is supportive therapy, including administration of antipyretics and analgesics, maintenance of hydration, respiratory support by either mechanical ventilation or extracorporeal membrane oxygenation (ECMO), and treatment with antibiotics in the case of bacterial superinfections. However, such treatments may not be sufficient for MERS-CoV infections, which may be more severe. Ribavirin and interferon alpha have been shown to have synergistic effects and are more beneficial when started early. Additionally, mycophenolic acid has been shown to be efficacious and can be used as a monotherapy; however, initial clinical trials included few patients, and further studies are necessary [27,28,29,30,31, 32]. Although several companies are

attempting to develop MERS-CoV vaccines, none are available yet. Improving our understanding of viral antibodies will facilitate the design of appropriate and efficacious vaccines.

Conclusion

MERS-CoV is a lethal zoonotic virus that originated in the Middle East. The main source of transmission, as has been shown in several studies, is through camels. Therapies are still under development and include ribavirin a, interferon alpha, and mycophenolic acid. Further studies are underway to develop an effective vaccine for MERS-CoV aiming to reduce the incidence and mortality rate of infection with this virus.

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