



A Review on the Primitive Strains of Coronavirus: Mers-Cov, Sars-Cov_1, their Epidemiology, Diagnosis and Biochemistry

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Abstract

Coronavirus is a vast terminology used for various viruses. Some viruses of this group are very dangerous and are vigorous and active against their host's immunity. Their effectiveness against the immunity is based on some special proteins which are not involved in the formation of structural components of virus. The present pandemic of coronavirus can be considered as the remnant of past global epidemics like SARS and MERS. These two strains were named SARS-COV-1 and MERS-COV and developed in 2002 and 2012 respectively. They were more deadly for humans as compared to CoVID-19. The transmission of both viruses is done by respiratory tract. The viruses of this family can infect animals, evolve and re-infect the next host (human) as a new strain. These viruses can be isolated from the host from nasal and throat swab and can be formulated from a method called bio-chipping. Self-hygiene is the foremost measure to avoid its infection.

Keywords: Zoonotic; Remnant; Epidemic; Pandemic; Reservoir; Bio-chip

Introduction

Coronavirus is the positive sense RNA virus. It is considered as the recombinant between avian and mammalian viruses. It is observed that the rate of mutation in RNA viruses is greater than DNA viruses. This may be due to the reason that RNA polymerase produces one mutation in each replication cycle and if we consider that the population of a particular virus is very large, then there will be a great number of strain production.

Many structural proteins are present within the viron which encode for spike proteins, nucleocapsid (N) protein and membrane (M) proteins. The nonstructural proteins (nsp) are specific for each strain of coronavirus and are associated with pathogenesis, host-virus interaction and severity of disease. Due to these proteins, some strains are more deadly (SARS-COV-1, MERS-COV and SARS-COV-2) and some are not (229E, NL63, OC43 and NKU1).

Mainly the coronavirus has seven forms due to its high mutation rate; four of them are benign to infect humans who are named as 229E, NL63, OC43, and NKU1 while other three are quite deadly for humans including SARS-COV-1, MERS-COV and SARS-COV-2. Nearly all coronaviruses have same replication strategy. All of viral strains are zoonotic and transferred from affected patient to healthy one. The reservoir for MERS-COV was camel and for SARS-COV-1 was civet cat. Supportive treatment is done for both infections.

SARS affected the patients of variable ages while MERS affected the patients who were mostly of older age. SARS-COV-1 is considered as the first pandemic of 21st century. Both of the viral strains commonly had similar symptoms like cough, fever, and pneumonia.

The receptor site for SARS-COV-1 was angiotensin-converting-enzyme-2 present on alveolar cells. After getting its entry in the host cell, it promotes the production of cathepsin L proteins which is pH sensitive. This cathepsin stimulates the apoptosis of the infected cell and within its stay, it has replicated in the cell and after the apoptosis, the newly made virions are released to infect nearby alveolar cells.

On the other hand, the receptor site for MERS-COV was dipeptidyl peptidase 4 which is present on bronchial epithelium and kidneys. It enters the host cell through its S proteins which is a type-I transmembrane glycoprotein with 1353 amino acid that exists on the viron surface recognized by the dipeptidyl peptidase 4 of the host cell. After replication, the newly made virions are released by exocytosis and infect the other nearby cells.

Methodology

As we know that coronavirus is an RNA virus so we need a set-up which involves reverse transcriptase enzyme to produce cDNA. Also RNA virus has many strains due to excessive mutation rate in them. So the technology which is used to counter this issue is biochip technique which can accommodate more than one probe in it. Mainly 3 probes are added while testing for coronavirus. To test for diagnosis, the swab from throat is taken from the suspected patient. After the isolation of virus, the next step is to extract the viral RNA. For this, the mixture of viral genome along with the viral protein is serially diluted. This dilution is 10 fold.

After the isolation of viral RNA, biochip technology is to hybridize the extracted genome. For coronavirus, the biochip of 3 probes in it is used to accommodate all possible known strains of coronavirus. The main principle of biochip technique is hybridization. This technique is used to measure the level of expression. Its probe has specific spots which have specific sequence which is hybridized by the genome of unknown organism or suspected species of disease.

As our suspect is RNA virus so we have to use reverse transcription process to form a complementary DNA by using the enzyme reverse transcriptase. This cDNA is used as template for amplification of viral

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Received Date: 28 December, 2020; Accepted Date: 11 January, 2021; Published Date: 18 January, 2021

RNA. Multiplex RT-PCR is used for diagnostic test. After that, these bands are compared and the viral strain is detected.

Results

As we know that MERS and SARS are highly lethal respiratory disease caused by single stranded positive sense RNA. WHO has given the confirmed case of MERS in May 31 2015 which is 1180 laboratory confirmed case and 843 deaths.

The mortality rate of SARS is 40%. While MERS affected 8424 people in 32 country and 919 were died. Moreover virus could mutate to have increased inter human transmissibility increasing its pandemic potential because no specific vaccine or drugs treatment are available. In order to test the desire effect people should be tested in area where virus is endemic.

Discussion

SARS-coV-1 and MERS-coV are the RNA viruses which belong to the same group known as coronavirus. They are named due the presence of spike on its structure which resembles like protruding rays from the sun. The RNA viruses have a lot of mutations while proof reading which produces a large number of strains. The lethal strains are SARS-coV-1, MERS-coV and SARS-coV-2. They have high epidemiology as they transmit through respiratory portal. It has been observed that those viruses which use respiratory system as pathway has large spread rate as they become aerosolized in the area where there is even a single patient. That's why wearing mask can be the first precautionary measure.

The primitive strains of coronavirus like SARS and MERS are also belong to those which were lethal for humans. Coronavirus is a broader term which also includes common cold virus and also the novel coronavirus. It has been closely observed that that novel coronavirus has 80% similar genome to the SARS. This seems quite close.

SARS was first appeared in 2003 in china which was transmitted to two dozens of other countries including North and South America as well. The proteins present on the exterior site are of almost same structure and those viruses have receptors on many cells. Not only on the lungs but also on other organs like kidneys. When the infection becomes disseminated, the other organs are also affected.

The statistics showed that there were only 8,000 confirmed cases and 700 deaths from that virus. In U.S, there were 29 cases with no death. The economy of Hong Kong was highly affected by this outbreak

The death rate for SARS was very high which means that mutation in that strain was very dangerous for humans. Vaccine for SARS-coV-1 was tested on mice but it needed a lot of time and experimentations. During those trials to make vaccine, the attenuated SARS-coV-1 was injected in patients. But this action resulted in the weakening of the host immune system. This was may be due to the fact that SARS has many receptors on different types of cells. There is might be a possibility that immune cells have also the receptor site for the lethal virus which resulted their destruction. Due to this factor, the project was inhibited. Also this virus had lower epidemiology as compared to novel coronavirus, so patients were kept in quarantine strictly and they were not in

large number so this disease got disappeared in late 2004 and after that no new cases were reported.

Another form of coronavirus was MERS which has lesser information about its severity and epidemiology. The first case was appeared in Saudi Arabia in 2012. Since then, this virus has irregular outbreaks in that area. This virus was spread in more than 25 countries and more than 75% cases were from Saudi Arabia. The source of infection was might be dromedary camel according to WHO. But this information has ambiguity.

To avoid these sorts of viruses, the main option is prevention. Also the strict isolation of the patient has very importance. To avoid respiratory viruses use masks and avoids close contact with the patients. The novel coronavirus has high epidemiology so self-hygiene is the first weapon to face this little enemy. If disease takes place, supportive treatment is done. The specific symptoms are treated along with the enhancement of the patient's immunity.

Conclusion

This systematic review demonstrated in the recent few years we have witnessed the widespread of three coronavirus diseases (including the recent COVID-19 pandemic) which have zoonotic origin. As the human and animals have come in close proximity there is a fear of such more pandemics. Moreover, because of the concentration of the population in major cities of the world the spread has become easier. We recommend keeping in check the potential sources of these viruses. There is also a need to invest more in coronaviruses related researches to investigate about their nuclear structure to contain them at the earliest and developing vaccinations more swiftly before these tiny potential monsters can cause a havoc.

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