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Review Article

Coronavirus Disease: Diagnosis and Treatment Aspects

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Abstract

Coronavirus is a serious problem, these days. Reliable diagnosis and treatment of such disease is required to be undertaken for better health care of the patients. Precautions and control of the disease with acceptable symptoms are highlighted. Possible diagnostic methods and treatment techniques are studied and described with working principle and applications. Future impacts are given for getting new methodologies. An attempt is made for research studies in coronavirus disease. Ultrasound research for coronavirus is discussed as a new technique for the diagnosis and treatment of the disease.

Keywords: *Corona Virus; COVId-19; Virus Structure; Sensor; Diagnosis; Therapeutic Treatment; Nano-Biosensors*

Introduction

By looking at the important development, of WHO (World Health Organisation) gave a global public emergency, on 30th January 2020 about the epidemic due to the 2019 novel coronavirus (2019-nCoV), started in a Wuhan seafood market, Hubei province, China. The virus disease is like bat SARS-CoV (covid) in the subgenus Sarbeco virus. Finally, the name adopted is coronavirus disease 2019 (COVID-19) [3]. Further, this has been termed as renamed with the acute respiratory syndrome coronavirus-2 (SARS-CoV-2) by the Health Committee of Viruses Taxonomy. The latest data. 27 March 2021 or later, has confirmed drastic due to COVID 19 pandemic disease. The virus of Wuhan strain a new strain of Beta coronavirus from group 2B with similarity of 70% genetic to the SARS-CoV [1].

Corona is 'crown' in Latin language and are transferred from animals to humans and vice versa. Virus is a core of genetic material with protein spikes. In the patients, there are respiratory symptoms, fever, cough and viral pneumonia and urgent care of the patient is required with testing methods and treatment plan, say by using appropriate vaccination [1-8].

These days, several methods are used for the detection of the virus problems for particular virus or the family for any disease. Thus, more studies are required to be taken up urgently. The details of the detection and treatment techniques for corona-virus disease are given. The structure and effects on the tissue due to virus are also given [1-11].

About COVID-19 virus

Corona virus, is detected when infection is developed in nose, sinus, and throat, with common cold and respiratory disease. Medically, this is a virus that infects humans in the upper respiratory system. In COVID-19, illness is caused to give respiratory syndrome coronavirus 2 (SARS-CoV-2) virus strain. COVID-19 virus also gives respiratory illness which is treated with conventional methods for treatment. Old age patients with problems like cancer, heart problem, breathing problem and diabetes, etc. [1,8-15] are sensitive to the infection.

Corona Virus is of four types (α, β, γ, and δ), which are analysed with biological test samples. Some new virus detected gives 2019 novel coronavirus (2019-nCoV). In March 21, 2020, reported cases were 80,967 by Chinese University with 3248 fatalities, in the country while many infection cases were among the hospital workers and doctors, with the COVID-19 disease and to the β-coronavirus genus.

Virus structure and function

Infection is caused by virus and intracellular parasites use metabolism to survive to produce the generations. Host cells are then destructed and the diseases are destroyed in the human patients.

Viruses having several structures, and these have of single or double-stranded DNA or RNA. The genome has protective layer of capsid protein. The capsid is surrounded by viral genome. The proteins with structure are nucleoprotein 'Viruses' infection is caused to life forms using viral digestive enzymes to finish he host cell membrane that enters membrane and the cell. Therefore, with the structure and enzyme system, antibiotics do not work to get viral infections. It has been detected that 219 viral species have been found with human virus infection, examples being yellow detected in 1901 and then new corona virus SARS CoV2 spread recently world over.

Symptoms of COVID-19

People get illness with COVID-19 like mild to moderate fever and recovered without hospitalisation. Importantly, the symptoms observed for coronavirus are dry cough, fever, dry tiredness, less, aches and pains, sore throat, diarrhoea, headache, conjunctivitis, loss of taste or smell, a rash on skin and discolouration of fingers or toes, or pneumonia, respiratory failure, heart problems, liver problems like septic shock, and death, caused by cytokine release syndrome or a cytokine storm The infection triggers immune system to flood the bloodstream with inflammatory proteins, cytokines, which kill the tissue and damage the organs [1].

Diagnostic procedures of corona virus

Properties based new generation of corona ii) viruses (SARS-CoV-2) and routine.

General methods [18-24]

Immunofluorescence method: ELISA

Enzyme immunoassays (EIAs) technique is linked to on the enzyme-linked immunosorbent assay (ELISA). Thus, protocols and materials are used as monoclonal antibodies with ELISA as the most useful for sensitive virus testing due to its speed, simple operation, and easy results analysis. These are simple, but time consuming [1].

Nucleic acid amplification tests (NAATs)

Viruses are diagnosed using biological samples and cell culture supernatants via particular tools and kits, to find their complementary target viral RNA or DNA sequences or by using NAATs. Nucleic acid is used to purify antibody for viral antigen to make antibody complexes. Polymer Chain Reaction (PCR) is involved here [1].

Polymerase chain reaction (PCR)

Real-time PCR methods have three targets. i) antibodies for new viruses, ii). This is more functional, iii). Real-time PCR is effective for production of immunosorbent assays [1].

Isothermal amplification

Amplification of DNA, in isothermal mode, is separated into two strands of the template against non-thermal method., helicase dependent amplification (HDA) and Recombinase Polymerase Amplification (RPA).

Also, an alternative isothermal amplification approach is to design primers such that the extension products to contain single-stranded primer binding sites [1].

Next-generation sequencing (NGS)

In virology, next-generation sequencing (NGS) is found [1] to identify new viruses with pyrosequencing [1].

Electron microscopy (EM)

Electron microscopy (EM) is used to detect virus with transmitters. This method monitors live images of cells and tissues with good resolution. Transmission electron microscopy (TEM) is good step in virus diagnosis, to target proteins within the virus structure, as harmless to RNA or DNA genomes. Immuno-electron microscopy (IEM) is also based on serological principles as ELISA and is useful for virus identification [1,11].

Cell culture

Cell hosts are provided by the large numbers of cells for the virus to help decrease the use of experimental animals, at lower risk of contamination. The viruses reach high top in the cells to be accessible for microscopic examinations [1].

Prominent techniques [21-28]

Nanoelectromechanical devices

High-frequency nanoelectromechanical systems (NEMS) are new sensors for the surface of nano-mechanical oscillators to detect pathogen viral binding to the natural frequency shift of NEMS devices [1].

Electrochemical nano-devices

Nanoparticles (NPs) associated with electrochemical detection are applied to detect viruses. A biosensor is used as an analytical tool to detect analytes combined with a physicochemical detector. These are quick and low cost techniques to detect pathogenic microorganisms in clinical samples.

Nano-biosensors

The existence or concentration of a biological analyte, like a biological system or a microorganism, or a biomolecule is used t0 recognise the analyte or biological identification part, as a signal transducer, and an amplifier, for immobilization of biologically sensitive substances on the surface of the biosensor. These are biomarkers for detecting nucleic acids, enzymes, microorganisms, tissues, viruses, bacteria, and antigens [1].

Nanomaterials (NMs) are developed as new possibilities for the further developed expansion of electrochemical biosensors. These are used in combination form with new advances in biosensor structures help to provide developed novel electrochemical assays. These are for cancer diagnostics and to detect microorganisms, or viruses [1].

Immunosensor

The electrochemical sensors are used to study hepatitis B e-antigen (HBeAg) DNA Biosensors.

The electrochemical DNA bio-sensing device has fast response time, and is user-friendly, with high specificity, and sensitivity. Voltammetry, amperometry, and impedance spectroscopy methods are useful in clinical and industrial applications [1].

Aptamer-based detection sensor

Aptamers are important artificial single-stranded DNA or RNA oligonucleotides with high affinity towards a target, for aptamer-based detection of viruses. These are fabricated by using aptamer as bioreceptors (capturing aptamer/probe) or transducers (signal aptamer/probe) [1].

Optical apta-sensors

When defined, surface plasma resonance or SPR aptasensors, is used to measure the resonance of free electrons in the metal films, by immobilizing on a metal surface, for virus binding, to change the thickness of the metal surface resulting in the alteration of the refractive index. Quantification is made by detecting the difference in the angle or intensity of light after the virus is bound to the aptamer, for the study 0f avian influenza virus (AIV) H5N1 and HIV [1,28,29].

Calorimetric sensors

In calorimetric-based apta-sensors, a shift in colour is used to find a virus, with a spectrophotometer. A nanomaterial is used as support for the aptamer or as a part of the transducer to create the signal with their assistance [1,30,31].

Fluorescence type

Fluorescent aptasensors, respond with fluorescent intensity or they respond with fluorescence polarization.

Electrical apta-sensors: Electro-mechanical sensor

When bending of the aptamer to the target, an electrical signal is produced to give enzymatic reactions, say in a field-effect transistor (FET), as voltage-controlled semiconductor device to regulates electrical behaviour by using an electric field to be used to detect the Tat protein of HIV-1.

Nano-mechanical system

In this case, a resonating nano-mechanical cantilever is made from polycrystalline silicon to detect the immune specific binding of viruses. Arrays of AcV1 antibody-by getting coated polycrystalline silicon nanomechanical cantilever beams are used to detect binding at different concentrations of baculoviruses in a buffer solution [1,18-23].

Here, mass of single-virus particles is bound to the cantilever through a viable technique is for sensitive detection of bound mass. Thus, with nanoelectromechanical device selective detection of the virus is made through virus - antibody interaction.

Bio-nanotechnology and BioMEMS [1]

A miniaturized PCR system for the diagnosis of COVID-19 and other infectious or diseases is used to study (Pavel Neužil, Northwestern Polytechnical University, P.R.China), webinar held on April 21, 2021. The performance of PCR (point-of-care) on sample drops placed on a disposable glass slide in contact with a micromachined silicon heater [1,25-27].

Newly developed methods

One of the novel methods to detect RNA is the RNA-targeting clustered regularly interspaced short palindromic repeats (CRISPR) method to use the enzyme.

Cas13 is used to target and destruction the different mammalian single-stranded RNA viruses., to produce a platform named SHERLOCK, which uses isothermal pre-amplification along with Cas13 to detect DNA or RNA. Their new protocol for SARS-COV-2, named "A protocol for detection of SARS-COV-2 using CRISPR diagnostics", is used on the website to detect nucleic acids [1].

Special immunosensor for covid detection

An Immunosensor is used for detecting, out of eight electrodes, attached to the same chip. These electrodes are covered with human SARS-CoV-2 and MERS-CoV antigens. Thus, two of the electrodes have been bound to BSA [1,28,29].

Treatment: Prevention and precautions

i) Hand washing is required frequently with or without alcohol to avoid any infection due to virus and avoiding the face is important [1].

ii) These days, different vaccination methods have been developed against coronavirus SARS-CoV. The antiviral points should be avoided from hands washing to avoid early protein formation [1].

iii) Drugs are being developed these days to avoid such proteins with viral problem replication [1].

iv) Antibiotics become ineffective for treating such infectious diseases (Figure 1). The world is facing to have deadly pandemic of Antimicrobial Resistance (AMR), as a cause of huge damage. The global health including food safety, nutrition security, livelihood are serious problem and Sustainable Development Goal are not achieved [1].

Specific cases: Applications

1. Cardiology

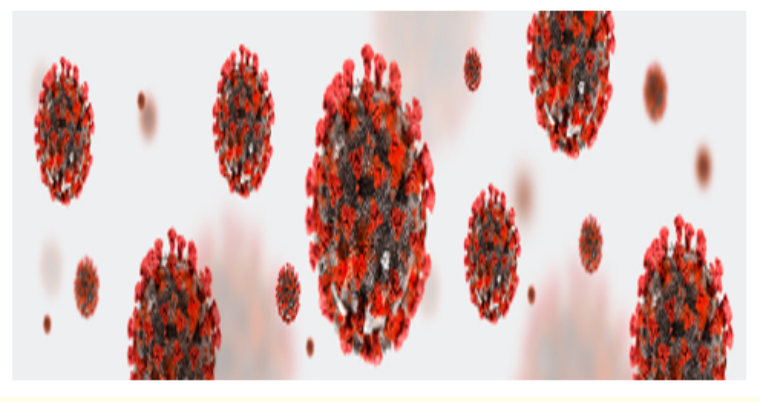

Figure 1: *Cardiac study during pandemic is shown as per ESC Newsletter of 24 March, 2021.*

2. Ultrasound: Ultrasound imaging gives diagnosis and therapy for destroying COVID-19, other related coronaviruses.

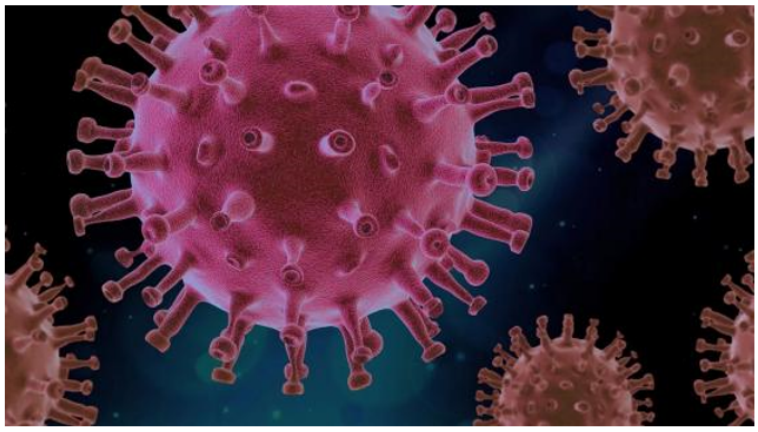

Figure 2: *Destruction images of virus with ultrasound.*

As is known, Ultrasound excitation is at 25 to 100 MHz, this gives vibration and coronavirus to vibrate the shell to destroy virus. Ultrasound waves give imaging information of corona virus results while therapeutic results remove coronavirus strains to treat the patients (Figure 2). This is a good breakthrough in the field of corona virus patient treatment against COVID-19, like kidney stone is integration [28-32].

Conclusion

Study of COVID-19 has been described as serious ongoing pandemic disease, to highlight the progress of infection by the SARS-CoV-2 virus that leads to severe permanent respiratory problems leading to almost death, Thus, urgent diagnostic strategies for early detection of the disease. SARS-CoV-2 to be developed is highlighted.

COVID-19 has been presented as a pandemic problem world over. Virus detection methods available for viral diseases are discussed, which depend on specific properties of each virus or virus family, Further investigations a Highly efficient and accurate detection method to detect and prevent the outcomes of the disease are given. Hence, there is an urgent need for more and precise studies in this field. In this article, prominent properties of a new generation of coronaviruses (SARS-CoV-2) are presented with routine virus detection methods and new techniques for samples of SARS-CoV-2 are proposed.

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