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Corona virus disease Covid19.Causes and prevention

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بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

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إِلَيْكَ وَحْيُهُۥ ۖ وَقُل رَّبِّ زِدْنِى عِلْمًا ﴿١١٤﴾

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Dedication

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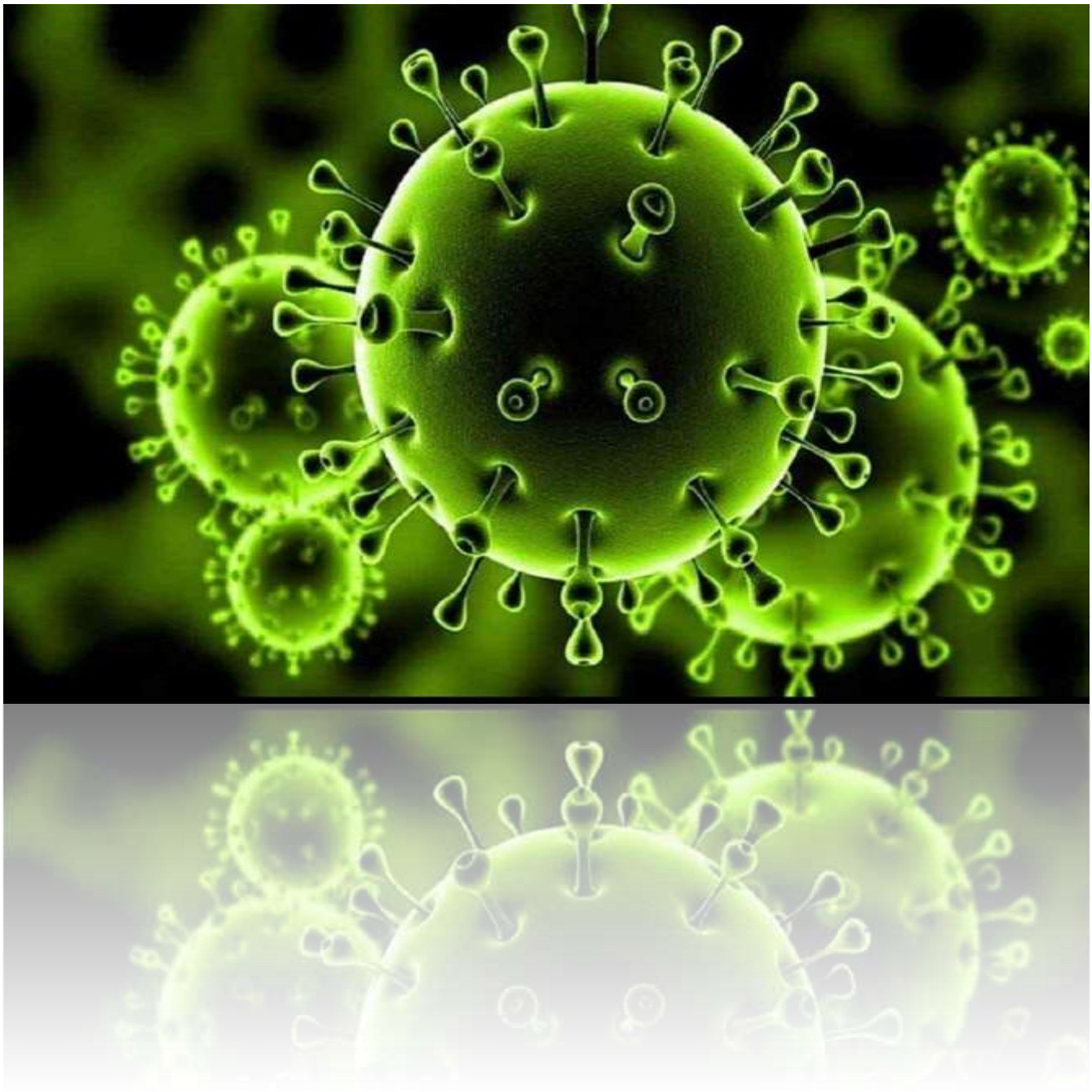
Summary

Coronavirus disease 2019 (COVID-19), has spread over 210 countries and territories beyond China shortly. On February 29, 2020, the World Health Organization (WHO) denoted it in high-risk category, and on March 11, 2020, this virus was designated pandemic, after its declaration being a Public Health International Emergency on January 30, 2020. World over high Efforts are being made to counter and contain this virus. The COVID-19 outbreak once again Proves the potential of the animal-human interface to act as the primary source of emerging Zoonotic diseases. Even though the circumstantial evidence suggests the possibility of an initial zoonotic emergence, it is too early to confirm the role of intermediate hosts such as[1]Snakes, pangolins, turtles, and other wild animals in the origin of SARS-CoV-2, in addition to Bats, the natural hosts of multiple coronaviruses such as SARS-Cove and MERS-Cove. The les-Sons learned from past episodes of MERS-Cove and SARS-Cove are being exploited to retort This virus. Best efforts are being taken up by worldwide nations to implement effective diagnosis, strict vigilance, heightened surveillance, and monitoring, along with adopting appropriate preventive and control strategies. Identifying the possible zoonotic emergence and The exact mechanism responsible for its initial transmission will help us to design and implement appropriate preventive barriers against the further transmission of SARS-CoV-2. This

Review discusses in brief about the COVID-19/SARS-CoV-2 with a particular focus on the role Of animals, the veterinary and associated zoonotic links along with prevention and controlStrategies based on One-health approaches



Chapter one (Introduction)

In the early days of December 2019, where people Planned to welcome New Year 2020, as well as the Chinese New Year, on January 25, 2020, news channels reported suffering of people with sporadic and Clustered incidences of “pneumonia of unknown ore-Gin” in the city of Wuhan under Hubei province, China (Gao 2020; Lu et al. 2020a). Subsequently, after month of the first report of infection on December12, 2019, the causative agent was swiftly identified AS a member of Coronaries family, and on January12, 2020, the World Health Organization (WHO) des-Ignited this fast-spreading virus as “2019-novel coronavirus (2019-nCoV)”, and Novel CoronaviralPneumonia and Cove-associated diseases were Referred to as “COVID-19” by WHO on February 11,2020 (Du et al. 2020; Tracinski and Meacher 2020).Later, this emerging virus was designated as “SARS-CoV-2” by the Coronavirus Study Group (CSG) of the International Committee on Taxonomy of Viruses (ICTV) (Gubernya et al. 2020). On March 11, 2020The WHO declared the situation as a pandemic Which is threatening mankind to a great extent(Chatterjee et al. 2020; Zheng 2020; Parke and Siunik 2020; Rundle et al. 2020). As of now, SARS-CoV-2 is considered as the seventh coronavirus that Infects humans. The

other coronaviruses (Coves)Include HKU1, NL63, OC43, 229E, SARS-Cove, undersoil. Among which SARS-Cove and MERS-Covered zoonotic and have resulted in high mortality out-Breaks in the last two decades, while the others are Usually associated with mild upper-respiratory tract Illnesses (Wei et al. 2020), and sometimes leading to Complicated disease, when occurring in Immunocompromised individuals (Villain-Gomez Et al. 2020).The culinary habits of Chinese people involve the Consumption of wild animal meat. The common Motivation that is responsible for the human con-Gumption of wild animal meat in China is due toothier believed medicinal value as well as the health-Promoting effects associated with the consumption Of certain wild game animal meats and their prod-Cuts (Haripur's and Chen 2020). The circumstantial Evidence that links the first case of COVID-19 to Tehama South Seafood Market that sells various Exotic live animals and our previous knowledge that Coronaviruses are animal-derived made us conclude The possible zoonotic transmission in SARS-CoV-2.Nevertheless, it is too early to jump into conclusions Since our knowledge of the primary source of infect-Tion is limited (Jalapa 2020). Identifying the origin ofSARS-CoV-2 will help us to unravel the exact mechanism responsible for its initial transmission. After Attaining a remarkable progress in developing field Oriented as well as high accuracy lab-based diagnose-Tics, much attention has been paved upon develop-Ingo effective vaccine and

therapeutics for blocking Person-person transmission, old age infections and Health-care workers infection [1]Thais critical for developing appropriate preventive and Control strategies against the fast-spreading SARS-CoV-2 infection. Looking at the beneficial propositions of hydroxychloroquine a multicentricRandomised study is underway to assess its effective-Ness as a prophylactic measure in curbing secondarySARS-CoV-2 infections as well as associated cclinicaSymptoms progression reducing overall the spread

Of the virus (Mitj a and Closet 2020)Originating from the central part of China, theSARS-CoV-2 pandemic not only dispersed in 369 Other cities of China but also crossed the inter-National boundaries within a short period (December To March 2020). As of May 2, 2020, COVID-2019 has Affected persons in more than 210 countries and territories in Asia, Europe, Africa, North America, and Latin America (Rodríguez-Morales et al. 2020a; WHO2020). Hence, due to very high transmissibility across The borders, it was declared as public health emergency of international concern by the WHO on January 30, 2020, and later as pandemic situation(**Kuldeep Dhama(May 2020)COVID-19: animals, veterinary and zoonotic links**

(Du Toot 2020; Rabbinate and Stone man 2020; Lilt al. 2020a, 2020b; Wood 2020; WHO 2020).At the beginning of 21st century, other coronavirus-Ruses like SARS-Cove and MERS-Cove, in 2002 and 2012, respectively have also caused severe

acute Respiratory distress (SARD) in the form of outbreaks But the current SARS-CoV-2 pandemic affected wider Population accounting a total number of nearly 4.71Million confirmed cases along with death toll of Nearly 0.31 million by May 17, 2020 (WHO 2020).These numbers are comparatively higher than SARS-Cove and MERS-Cove cases but with lower case fatality Rate. The occurrence of this pandemic has adversely Affected the global economy, especially in develop-Ingo nations. This outbreak not only dejected the Multinational businesses, disrupted the global mar-Kept trading, tourism, transportation, export-import, But also reduced the income generated from the Market (Amite et al. 2020).China is home for several farms that rears several Animal species such as deer, snakes, porcupines,[**COVID-19: animals, veterinary and zoonotic links. Kuldeep Dhama2020**] Foxes, civets, bears, turtles, bamboo rats, mink, and Birds. Such farms can be targeted to find the origin Of SARS-CoV-2 (Zhao et al. 2020). Before declaring Snakes, pangolins or even dogs as the reservoir host Of SARS-CoV-2, a set of established principles called AS the Koch's postulates have to be satisfied. Hence, It is unethical to cull these animals without any con-Collusive evidence of SARS-CoV-2 transmission from Animals-to-humans (Brownie 2020). The recent Reports of SARS-CoV-2 in animals such as dogs, cats, And a tiger have resulted in unnecessary fear among The general public as well as pet owners and have Negatively

impacted the welfare of animals(Parry 2020). The present compilation highlights, in brief, abutSARS-CoV-2, causing emerging coronavirus disease(COVID-19) in humans with regards to the role of Animals, veterinary importance, zoonotic aspects, And salient prevention and control strategies focus-Ingo on One-health approaches to restrain and com-Bat this pandemic virus. Coronaviruses are a group of related Viruses that cause diseases in mammal sand birds. In humans, coronaviruses Cause respiratory tract infections that Can range from mild to lethal. Mild Illnesses include some cases of the Common cold (which has other possible Causes, predominantly rhinoviruses),While more lethal varieties can causers, MERS, and COVID-19. Symptom sin other species vary: in chickens, they Cause an upper respiratory tract disease, While in cows and pigs they cause Diarrhea. There are yet to be vaccines or Antiviral drugs to prevent or treat human Coronavirus infections.

Chapter two (Review and literatures)

Coronaviruses are a group of viruses that cause diseases in mammals and birds. The virus causes respiratory infections in humans, which include colds and are usually minor, and rarely fatal, such as severe acute respiratory syndrome, Middle East respiratory syndrome and the new Corona virus, which caused the outbreak of the new Corona virus 2019-20. It may cause diarrhea in cows and pigs, while in chickens it may cause upper respiratory diseases. There are no approved vaccines or

antivirals to prevent or treat these viruses. Coronaviruses belong to the straight Coronavirus family within the Coronavirus family within the order of novirus viruses. Coronaviruses are enveloped viruses with the positive-directional single-stranded RNA genome and have a symmetric helical nucleus capsid. Coronaviruses have a genome of about 26 to 32 kilobases, and it is the largest among RNA

viruses.Genus:

Corona virus alpha; Typical species: alpha corona virus

Species: Alpaca Coronavirus, Coronavirus Alpha 1, Human Coronavirus 229E, Human Coronavirus NL63, Corona Virus Curved Wing Bat 1, Coronavirus Curved Wing Bat HKU8, Epidemic Swine Diarrhea Virus, Horseshoe Bat Corona Virus HKU2, Coronavirus [**International Committee on Taxonomy of Viruses (ICTV) March 2019**]

Genus Corona virus beta; Typical species: mouse corona virus

Types: Beta 1 Coronavirus, Human Coronavirus HKU1, Mouse Coronavirus, Pipistrellus Bat Coronavirus HKU5, Rosetta Bat Coronavirus HKU9, SARS Coronavirus, Murine Coronavirus, Tylonycteris Bat Coronavirus HKU4, Middle East Respiratory Syndrome Coronavirus, Human Coronavirus OC43, EriCoV Coronavirus, Severe Acute Respiratory Syndrome Type 2 (2019-nCoV) Coronavirus

Corona virus genus gamma; Typical species: avian corona virus

Types: avian corona virus, white whale virus SW1, duck corona virus, infectious bronchitis virus

Genus Corona Virus Delta; Typical species: HKU11 bilovirus

Species: bulimia corona virus (HKU11), coronavirus (HKU13), foot and mouth (coronavirus) virus (HKU12)It has been recognized that Coronaviruses have been causing disease states in veterinary medicine since the early 1970s. With the exception of infectious bronchitis, major illnesses related to these viruses are mainly intestinal diseases[5]

Caused diseases

Coronaviruses mainly infect the upper respiratory tract and gastrointestinal tract in birds and mammals. It also causes a range of diseases in livestock and pets, some of which are dangerous and considered a threat to agricultural and animal husbandry activities. In chickens, the infectious bronchitis virus (IBV), which is a corona virus, not only targets the respiratory tract, but also the genitourinary system, and this virus can spread to various organs through chickens. Among the corona viruses that cause significant economic damage in livestock: porcine corona virus (TGE virus) and bovine corona virus, which cause diarrhea in young animals. Feline corona virus is of two types, one of which is the enterovirus feline corona virus, which is a

pathogen of low clinical importance, but the random mutations of this virus result in feline infectious peritonitis, a disease with a high mortality rate. Similarly, there are two types of corona virus that infect a ferret: Feline enterovirus corona virus causes a gastrointestinal syndrome known as ECE) and another, more dangerous systemic type (such as feline infectious peritonitis virus in cats) is known as corona virus. Nizami Ibn Mogradi (FSC). There are two types of canine corona virus, one of which causes moderate gastrointestinal disease and the other causes respiratory disease. Mouse hepatitis virus is a corona virus that causes disease epidemics in mice with a high mortality rate, especially among colonies of laboratory mice. The sialadenitis and lacrimal gland virus (SDAV) is a highly contagious corona virus among laboratory rats and can be transmitted between individuals through direct contact or aerosols. Acute infection with this virus has a high mortality rate and a tendency towards the salivary, lacrimal and harder glands. A bat corona virus related to HKU2 virus called porcine acute diarrhea syndrome (SADS-CoV) causes diarrhea in pigs. Before the discovery of the SARS coronavirus, the mouse hepatitis virus (MHV) was the best study corona virus, whether biologically or in the laboratory, as well as at the molecular level. Some mouse corona strains cause progressive demyelinating encephalitis in mice that has been used as a mouse model of multiple sclerosis. Significant research efforts

have focused on elucidating the viral pathogenesis of these animal coronaviruses, especially by virologists interested in veterinary and zoonotic diseases. In pets A avian infectious bronchitis virus (IBV) and causes avian infectious bronchitis.Porcine Coronavirus (Transmissible Pig Gastroenteritis Virus, TGEV). [**An overview on Severe AcuteRespiratory Syndrome (SARS 2005;]**

Bovine Coronavirus (BCV) responsible for acute enteritis in young calves. Feline corona virus, which causes moderate infections in cats, as well as acute feline infectious peritonitis (by other types of the same virus).

Two types of canine corona virus (CCoV) (one causes intestinal infections and the other causes respiratory diseases). Turkey virus coronavirus (TCV) causes enteritis in turkeys. Enterovirus corona virus is a focal point and causes enteric enteritis in ferrets. Systemic Coronavirus is the son of ferrets and causes a feline infectious peritonitis-like syndrome in feline children. Totalitarian canine virus. Enterovirus rabbit virus, which causes acute gastrointestinal disease and diarrhea in European young rabbits, the mortality rate is high. Another new veterinary disease caused by the porcine diarrhea epidemic virus (PEDV) has emerged around the world, and its economic importance is still unclear, but it causes a high mortality rate in pig[8[

The rapid emergence of severe acute respirato-Ry syndrome (SARS) in 2003 caught the medical Profession by surprise and posed an enormous Threat to international health and economy By the end of the epidemic in July 2003, 8098 Probable cases were reported in 29 countries and Regions with a mortality of 774 (9.6%) A nov-lEl coronavirus (CoV) is responsible for SARS and the genome sequence of the SARS-CoV is Not closely related to any of the previously charac-Terized coronaviruses . In this article, the Epidemiology, clinical presentation, and the possi-Ble therapeutic agents are reviewed.

Epidemiology

In Nov 2002, there was an unusual epidemic of

Severe pneumonia of unknown aetiology in Fos-Han, Guangdong Province in southern China, withA high rate of transmission to healthcare workers (HCWs) . A retrospective analysis of 55 pa-Tients admitted to a chest hospital with atypica Pneumonia in Guangzhou between Jan 24 and Feb18, 2003 showed positive SARS CoV in the na-Sopharyngeal aspirates (NPA) whereas 48 (87%)Patients had positive antibodies to SARS CoV in Their convalescent sera. Genetic analysis showed That the SARS CoV isolates from GuangzhouShared the same origin with those in other coun-Tries, with a phylogenetic pathway that matched the Spread of SARS to other parts of the world SARS-CoV appears to have originated fromWild animal

reservoir in mainland China because Masked palm civets (Paguma larvata) and the rac-Coon dog (Nyctereutes procyonoides) had a CoV Almost identical to that in SARS patients. There Was also a much higher sero-prevalence of SARS-CoV among wild animal handlers than controls inGuangdong A 64-year old physician from southern China,Who had visited HK on 21 Feb 2003 and died ten Days later of severe pneumonia, was the source of Infection causing subsequent outbreaks of SARS In HK Vietnam, Singapore [2] and Canada At least 16 hotel guests or visitors were infect-Ed by the Guangdong physician while they wereVisiting friends or staying on the same floor of Ho-Tel M, where the physician was staying in HK.Through international air travel, these visitors Spread the infection globally within a short period.SARS appears to spread by close pperson-toPerson contact via droplet transmission or fomiteThe high infectivity of this viral illness is re-Flected by the fact that 138 patients (many ofWhom being HCWs) were hospitalized with SARSWithin 2 weeks as a result of exposure to one sin-Gle patient (a visitor of Hotel M), who was admit-Ted with community acquired pneumonia (CAP),on a general medical ward at the Prince of Wales

Hospital (PWH)in HK This super-spread-Ing event was thought to be related to the use ofNebulized bronchodilator for its muco-ciliaryClearance effect to the index case together with Overcrowding and poor ventilation in the hospitalWard SARS-

CoV was also detected ii Tears, and this might be another source of spreadAmong HCWs and inoculating patients In ad-Dition, there was evidence to suggest that SARS Might have spread by airborne transmission in aMajor community outbreak in a private residentialComplex in HK There are several other hy-Potheses for this major outbreak including passive

Carriage of virus by pests, drying up of U shaped Bathroom floor drain, and faecal-oral viral loadingThrough contaminated surfaces as a result of theChimney effects created by the use of exhaust fans In the presence of blockage of the contaminated Sewage system . There are however addi-Tional data in support of SARS having the ppotentia Of being converted from droplet to airborne dropletTransmission. Air samples obtained from a room Occupied by a SARS patient and swab samplesTaken from frequently touched surfaces in rooms And in a nurses' station were positive by PCR test-IngThe temporal-spatial spread of SAR Among inpatients in the index medical ward of thePWH in HK was also consistent with airborneTransmission These data emphasize the needFor adequate respiratory protection in addition to Strict contact and droplet precautions.

Infectious bronchitis

Age affected: All, young are most susceptible.

Causes: Infectious bronchitis virus is a coronavirus, and is the most contagious viral respiratory disease in poultry.[9]

Effects: Sneezing and watery eyes are seen early on, followed by depression, coughing and nasal discharge. Producing birds exhibit drop in egg production or weight gain. Eggs have poor shell quality and watery albumin. Layers also have ruffled feathers and wet droppings. Tracheal rales, gasping and urate diarrhoea are also seen.

Causes

It is caused by a coronavirus

Spreads rapidly by aerosol. Contaminated faeces, litter and fomites spread the virus. It is one of the most contagious viral respiratory diseases in poultry.

Clinical signs

Sneezing and watery eyes are seen early on, followed by depression, coughing and nasal discharge. Poor egg shell quality, watery albumen, ruffled feathers and wet droppings are seen in laying birds. A drop in egg production and weight gain, tracheal rales, gasping and urate diarrhoea are also seen.Postmortem lesions[10]

Exudate in trachea, nasal turbinates, air sacs thickened or frothy and pneumonia can be seen. In young birds misshapen (nonpatent and hypoglandular) ova and oviduct, and yolk in

abdominal cavity. Occasionally swollen pale kidneys with urates are found.

Diagnosis

Virus neutralisation, HI or ELISA test for measuring antibody are helpful. Virus isolation in embryos or chicken kidney cell cultures and/ or PCR are necessary for a definitive diagnosis. Curling, stunting and death of embryos can be seen in inoculated embryonating eggs. Respiratory signs and lesions with kidney lesions give a presumptive diagnosis.

Treatment & control

Prevention

Vaccinate birds with multiple serotypes (depending on region) for broad spectrum protection.

Internationally, generally single vaccines are used (H120 or cloned type MA5) or Mass-Conn. In the US various vaccines contain the Ga or Ark subtypes as well. They are administered by spray at day of age in the hatchery or in the field by drinking water or spray. The viruses can be subtyped by real time PCR or using monoclonal antibodies and ELISA.

Covid 19 vaccines

Competent authorities and how do they work?

Currently, several COVID-19 vaccines are in clinical trials. The US Food and Drug Administration will evaluate the results

of these experiments before approving the use of Covid 19 vaccines. But because there is an urgent need for Covid 19 vaccines, and because the US Food and Drug Administration approval process can take between several months to several years, the Food and Drug Administration will issue an emergency use license Covid 19 vaccines are based on less data than is usually required. The data must show that vaccines are safe and effective before the FDA can issue an emergency use license. Vaccines that have received an emergency use license from the US Food and Drug Administration include the following:

Pfizer-Bionic vaccine for Covid 19. The Covid 19 vaccine produced by Pfizer-Biointec is 95% effective in preventing symptoms of the Covid 19 virus. This vaccine is for people 16 years of age and over. It requires two injections, 21 days apart. A second dose may be given up to six weeks after the first dose, if needed. Moderna vaccine for Covid 19.[2] The Covid 19 vaccine produced by Moderna is 94% effective in preventing symptoms of the Covid 19 virus. This vaccine is for people 18 years of age and over, and requires two injections 28 days apart. A second dose may be given up to six weeks after the first dose, if needed.

Janssen / Johnson & Johnson vaccine for Covid 19. This vaccine was in clinical trials 66% effective in preventing symptomatic Covid 19 infection, 14 days after the vaccination.

The vaccine was also 85% effective in preventing severe Covid 19 infection, at least 28 days after the vaccination. This vaccine is for people 18 years of age and over, and requires one injection. The US Food and Drug Administration (FDA) and the Centers for Disease Control and Prevention (CDC) have recommended that they temporarily stop distributing this vaccine due to rare reactions in the form of a blood clot in the small number of people who have taken it.[**1998-2021 Mayo Foundation for Medical Education and Re (MFMER).**]. "Human coronaviruses: insights into environmental resistance and its influence on the development of new antiseptic strategies"Both Pfizer-Bioentec and Moderna use messenger RNA (mRNA) in COVID-19 vaccines. On the surface of Coronaviruses are spiky-shaped entities called the S protein. Covid-19 vaccines based on RNA sent to cells give instructions on how to make a harmless portion of One of the S. proteins. After grafting, cells begin to make protein fragments and project them on cell surfaces. Your immune system will realize that the protein is an intruder and will start building an immune response and making antibodies.

The Janssen / Johnson & Johnson COVID-19 vaccine is a vaccine that uses vector technology. In this type of vaccine, scientists take genetic material from the Covid 19 virus and insert it into a different type of live vulnerable virus, such as an adenovirus. When the weak virus (viral vector) enters your

cells, it delivers genetic material from the Covid 19 virus that gives your cells instructions to make copies of the S protein. Once the cells display S proteins on their surfaces, the immune system responds by creating antibodies and defensive white blood cells. If you become infected with COVID-19, the antibodies will fight the virus

Virus vaccines cannot cause infection with Covid-19 or the vector virus. Also, the genetic material that the carrier delivers will not become part of your DNA.

Chapter three (Results)

In conclusion, we believe that further work is absolutely needed in order to better characterize The transmission barrier(s) between Coves and different animal species, along with the virus- and theHost-related factors underlying cross-species jumping within different environments as well as at the Level of the various ecological interfaces. Strengthening public health surveillance systems, iincludinVeterinary services and wildlife monitoring, could provide early warnings and predict possible futureEmergencies [300].Supplementary Materials: The following are available online at http://www.mdpi.com/2076-2615/10/12/2377/s1,Table S1: Coronavirus-associated diseases in animals and list of lesions in the main affected tissues.

Author Contributions: V.Z., S.F. and M.C. have given major contribution to conceptualization and assembling[12]

Of the review. F.B., G.B., A.C., L.C., C.C., G.C., S.D.V., M.E.G., S.M., V.M., N.R., A.S., F.T. and R.V. have equally Contributed to specific paragraphs and realization of the schemes, they are listed in alphabetical order. All author shave read and agreed to the published version of the manuscript. Funding: This research received no external funding. Acknowledgments: Sam Marco is supported by an American-Italian Cancer Foundation PPost-DoctoraResearch Fellowship.Conflicts of Interest: The authors declare no conflict of interest.

Chapter four (Discussion)

The tremendous amount of animal diseases caused worldwide by a variety of Cove strains several species indicate the vast spreading of Coves in the ecosystem and their ability to change, adapt, And progressively cause new animal diseases over time. The adaptation during cross-species jumps indifferent species including domestic and wild mammals, as well as birds, may play a role in enabling Viral spillover from natural hosts to humans. Moreover, infection of domestic species from human Coves has also been partially documented and recently demonstrated for SARS-CoV-2 [293], indicating potential mutual role in the transmission of the infection. Extensive genomic studies of both human and animal Coves allow for a

better understanding of[14]The origin and evolution of pathogenic Coves, pivotal for disease control and treatment, and hopeful Helping in avoiding the new wide spreading of life-threatening diseases. In the One-Health age, An increased animal-to-human transmission is already evident of viral pathogens such as Ebola, Influenza viruses, Hendry, Nipa, and Coves. Ecosystem changes, including climate changes, Urbanization with increased human population, and cultural and social changes, as well as sseculaTraditions [294], account for this new spreading of zoonotic epidemics of which we should regrettably Expect more in the future. For these reasons, animals, humans, and the environment should be considered as part of the same Scenario and a better understanding of the interaction between the different components could help in Preventing and controlling any future spill-over towards the human sphere. A proper management of Environmental factors by increasing attention to land usages aimed to preserve biodiversity, to prevent A wild/domestic interaction, and to avoid stressful conditions to wild species reservoirs seems thobe a good approach in reducing spill-over risks. This stresses the urgent need of multidisciplinary

Approaches and a constant monitoring of the wild animal sphere. A proper surveillance program Including constant reporting and investigations on dead wild and domestic species could help to

Anticipate the spread of a similar epidemic. AS previously discussed, Coves, like other positive-strand RNA viruses, have the ability to manifest And acquire genetic diversity due to some typical features, such as the infidelity of the RRNA-defender polymerase, the high frequency of homologous and heterologous RNA recombination, and the Large genomes [295]. This genetic variability confers to Coves the high potential of evolution that

Occasionally allows them to overcome species barriers and host specificity [296–298].Some studies indicate that possibly all Coves are genetically derived from common ancestors Residing in bats, which are usually naturally infected and asymptomatic long-lasting reservoir (Alpha and Beta coronavirus), and in birds (Delta and Gamma coronavirus) [12,32,295,299]. The different behavior of

Coronaviruses in bats and birds could also be related to the unique properties of these two groups of Animals. The diversity of bats and birds themselves is huge, their flying capacity has allowed them to Spread worldwide, and their habits provide frequent opportunities of aggregation [299].The genomic diversity of Coves accounts for their variation in species adaptation related to receptor Binding ability and, consequently, tissue tropism, producing localized versus systemic diseases affecting Different organ systems [12]. As an example, SARS-Cove uses ACE2 as a receptor and primarily infects Ciliated

bronchial epithelial cells and type II pneumocystis, whereas MERS-Cove uses DPP4 and infects on-ciliated bronchial epithelial cells and type II pneumocystis [12].As described in the text and summarized in Table S1, in Cove infections, three major organ systems Appear to be involved: the respiratory, the alimentary, and the nervous system (Schemes 3–5). Usually,

Human Coves cause mainly respiratory diseases (Alpha- and Beta-coronavirus), whereas other mammals Manifest predominantly gastroenteritis and a less frequent, but typical for some diseases/species, Nervous involvement (Alpha- and Beta-coronavirus). All Alpha- and Beta-coronaviruses seem to have

Originated in bats, whereas a separate origin is postulated for avian Delta- and Gamma-coronavirus, Rarely affecting mammals (i.e., pigs) and causing mainly respiratory pathologies [12,32,299].

Interestingly, genomic diversity can not only modify Coves among species but also within the Same species, conferring new ability to spread within the organism. A typical example is the case of Fifer which risk factors for host and environmental spreading, maintenance, and genetic change associated With increased disease severity are ascribed to animal-to-animal contact and poor infection controls. Additionally, the importance of the genetic background of the host is also

relevant, as demonstrated by•**[Baden, L.R., Rubin, E.J., 2020. Covid-19 – the search for effective therapy. N. Engl].**

The similar disease evolution in domestic and wild felids. Notably, histopathological evaluation of Coves in animals has underlined similarities with humongous, such as the typical alveolar damage and the vascular thrombosis with fibrous exudation, Occasional syncytia formation, depletion of lymphoid organs, and the direct intestinal epithelial damage. AS for many other pathological processes (e.g., tumors), animals could therefore not only benefit from Human medicine but also represent a model as well as an important ring in epidemiological chains That need to be studied and monitored. Investigating the lesions and distribution of Coves can therefore be crucial to understand and Monitor the evolution of these viruses as well as of other pathogens in light of the One-Health Approach. Unfortunately, mainly in animals, accurate postmortem examinations and histopathological Investigations are infrequently performed However, histopathological characterization, especially IN cases with fatal COVID-19, is considered critical to further understand the pathogenesis and

Transmission of this disease in order to help public health preventive measures and therapies.

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