Virology & Mycology
ISSN: 2161-0517
OPEN ACCESS Freely available online
Review Article

Possible Collaboration of Veterinarians and Medicos over the Fight against Covid-19 with "One-Health Approach"

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ABSTRACT

As of now, SARS CoV-2 has been identified as seventh human-infected coronavirus. Certain coronaviruses (CoVs) include SARS-CoV, 229E, HKU1, OC43, NL63 and MERS-CoV, of which SARS-CoV and MERS-CoV are zoonotic and have resulted in high-percentage outbreaks over the past two decades, while rest of them is typically associated with mild upper respiratory diseases. On 11 March 2020 the WHO announced the situation to be a pandemic that threatens humanity with a wide range. Of the new, bat and pangolins are thought to be the possible origins of SARS-CoV-2 inchoation. The COVID-19 pandemic is putting uneven stress on public health systems around the world. To mitigate the impact of this rapidly spreading virus a multidisciplinary collaborative approach is needed.

Since all pandemic viruses that emerged in the last century originate in the animal world and the ongoing changes in the respective interfaces between humans, animals and the environment have led to an increase in major predisposing factors that allow zoonotic viruses to emerge as novel human pathogens, 'peacetime' pandemic preparedness efforts should follow a 'One Health approach'.

Keywords: Coronavirus; Covid-19; Pandemic; Virus; Pneumonia; Respiratory disease; Influenza

INTRODUCTION

Towards the end of year 2019, news outlets reported that sporadic population is suffering from pneumonia with uneven presentation which they reffered as "pneumonia of obscure origin" in Wuhan that is a city in China [1, 2]. About a month after this report i.e. on January 12, 2020, the pathogen was quickly identified to be the part of family Coronaviridae, this virus spreaded rapidly was identified as "2019-novel coronavirus (2019-nCoV)" and on February 11, 2020 the diseases related to this nCoV were clasiified under "COVID-19" by WHO [3-5]. Later, the advanced and exclusive study about this virus unlocked its identification as "SARSCoV- 2" carried out by the Coronavirus Study Group (CSG) that is a part of International Committee on Taxonomy of Viruses (ICTV) [6].

On March 11, 2020 the WHO declared the situation a pandemic that threatens humanity with wide spectrum [7-11] as of now, SARS CoV- 2 has been identified as seventh coronavirus that infects humans. The other coronaviruses (CoVs) include SARS-CoV, 229E, HKU1, OC43, NL63 and MERS-CoV, Among which SARS-CoV and MERS-CoV are zoonotic and have resulted in outbreaks with high percentage in last two decades, while rest among them are usually associated with mild upper-respiratory tract illnesses [12] and sometimes leading to complicated disease, when occurring in immunocompromised individuals [13]. Originating from a city of China, the pandemic SARS-CoV-2 not only dispersed in 369 other cities of China but also transcended international borders in a short period of time (December to March 2020). As of August 24, 2020, COVID-2019 has affected persons in about 227 countries along with territories in Asia, Europe, Africa, Latin America (WHO 2020).

Consequently, because of exceptionally high contagiousness over the outskirts, it was pronounced as public health emergency of international concern by the WHO on January 30, 2020 and later as pandemic circumstance [14-17]. With the commencement of 21st century, other coronaviruses like SARS-CoV and MERS-CoV, in 2002 and 2012, respectively have also caused Severe Acute Respiratory Distress (SARD) that resulted in outbreaks but the current SARS-CoV-2 pandemic affected wider population accounting a total number of nearly 23.42 million confirmed cases

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Received: January 05, 2021; **Accepted:** January 19, 2021; **Published:** January 26, 2021

Citation: Sofi OMU, Sofi TA, Bandroo G, Javid F, Nabi B, Sheikh AA. (2021) Possible Collaboration of Veterinarians and Medicos over the Fight against Covid-19 with "One-Health Approach". Virol Mycol. 10:200.

along with death toll of nearly 0.81 million by August 24, 2020 (WHO 2020). These numbers are comparatively higher than MERS-CoV and SARSCoV cases but with lower case fatality rate. This outbreak had a ravaging effect on the global economy, especially in developing nations. This outbreak not only discourage global businesses, disrupts global marketing, tourism, travel, exports, but also reduces market earnings [18]. The current compilation highlights, in a nutshell, about SARS-CoV-2, which causes the emerging novel coronavirus (COVID-19) to exist in humans in the form of animal role, veterinary importance, zoonotic aspects and salient recomendations focusing on One-health approaches to restrain and combat this pandemic virus.

HOST RANGE

Coronaviruses (CoVs) infect man as well as domestic and wild animal species and typically infections stay sub-clinical in most cases [19-21]. The clinical form varies from enteritis in cattle, horses and swine, upper respiratory tract disease in cattle, dogs, felines and poultry and common cold to highly fatal respiratory infections in humans [22]. Among the four genera in the Coronaviridae family, Alphacoronavirus and Betacoronavirus customarily infect mammals and have probable bat origin, while Gammacoronavirus and Deltacoronavirus infect birds, fishes and mammals and are assumed to have swine origin [23-27]. The genus Betacoronavirus carries potential zoonotic pathogens like MERS-CoV and SARS-CoV having bats as primary host and palm civet cat and dromedary camels as intermediate hosts, respectively [28-30]. Many CoVs have been recovered from birds such as Bulbul coronavirus HKU11, Wigeon coronavirus HKU20, Munia coronavirus HKU13, Night-heron coronavirus HKU19, White eye coronavirus HKU16 and Common moorhen coronavirus HKU21.

The common pig infecting coronaviruses include Porcine Coronavirus HKU15, Transmissible Gastroenteritis Virus (TGEV), Porcine Epidemic Diarrhea Virus (PEDV), and Porcine Hemagglutinating Encephalomyelitis virus (PHEV) which are being reported from many parts of the world [31]. A list of other animal species also reported harbouring the CoVs such as cattle, horses, swine, dogs, cats, camels, rabbits, rodents, birds, ferrets, mink, bats, snake (such as Chinese cobra and krait), frogs, marmots, hedgehogs (Erinaceus europaeus), Malayan or Javan or Sunda pangolin (Manis javanica), many other wild animals and their role as carrier/reservoir needs urgent attention [32].

ZOONOTIC RELATIONS OF SARS-CoV-2

During SARS and MERS outbreaks, coronaviruses have breached the species barrier twice in the past and hence SARS-CoV-2 appears to be the result of a third species barrier jumping. Recent zoonotic CoVs such as SARS-CoV, MERS-CoV and SARS-CoV-2 have acquired greater consistency due to human disease astringency and global spread [33]. The emergence of new CoVs and their wide host range may be attributed to instability of the replicase enzyme, RNA-dependent RNA polymerase, polybasic furin cleavage site and O-linked glycans, lack of proofreading mechanism, a higher rate of spike gene mutations in the RBD and genetic recombination [34]. Researchers also showed that SARS-CoV and SARSCoV- 2 (2019-nCoV) both use ACE2 as a homogeneous cell ingress receptor [35]. Because of the mutation in the S CoV gene RBD region, the host range is expanded to infect other host species of animals or humans, the pathogenicity and transmissibility of the virus can be further altered and increased, thus becoming a matter of global concern [36].

While probing the source of SARS-CoV-2, it was visually examined that the initially infected individuals had a prevalent exposure spot. It was South China Wet Seafood wholesale market in Wuhan, Hubei Province, China, where restaurants are famous for offering various domestic animals, wild animals and live animals including poultry, rabbits, bats, snakes, pangolins, turtles, hedgehogs, badgers and marmots for human consumption [37]. Wuhan Seafood Market 's initial inferences hypothesized animal source affixes and wild animals for the SARS-CoV-2 spillover. Findings denoted the probability of a zoonotic substructure, as CoVs tend to circulate amongst various types of plants, vertebrates and humans due to a broad range of host. It was postulated that SARS-CoV-2 got initially transmitted from animals to humans, followed by maintaining via human-to-human transmission [38]. In the case of MERS-CoV, there is evidence that the viral RNA is not only shed by nasal secretions and feces but from milk as well, suggesting the peril of food-borne transmission of MERS-CoV [39]. Furthermore, in some studies a high proportion of camels presenting for slaughter corroborated the shedding of nasal MERS-CoV [40-42]. Therefore, the risk of SARS-CoV-2 being the infection of food-borne CoV transmitted by the respiratory route cannot be abnegated [43]. Literature records that some of the bat launching SARS-CoVs were possibly capable of infecting humans. As previously discerned, bats were found to be involved in the transmission of SARS-CoV and MERS-CoV, so researchers predicted the role of bats in the initiation and transmission of the current SARS-CoV-2 pandemic [42,31] For the time being, it is understood that the SARS-CoV-2 is approximately cognizant of the bat coronavirus that was isolated from horseshoe bat, the bat species that is considered to be a host of SARS-related precedent CoVs. Therefore, SARS-CoV-2 may have originated from the sequential recombination that occurs between the precursors of coronaviruses associated with SARS. A snake SARS-CoV-2 was proposed as the SARS-CoV-2 reservoir based on codon use bias [19]. But other researchers later disputed this suggestion. This is the explanation why the presence of an intermediate animal host responsible for the zoonotic spill-over to humans is suspected [44,45].

Likewise, not only bats but SARS-related coronavirus has been transmitted from humans to pigs [36]. It is pertinent to mention that pigs had been predominant species for the evolution of many incipient strains of Influenza A virus in the past when present in close sodality with avian and human species and as bat CoVs are infecting pigs, the possibility of evolution of any incipient virus involving influenza and corona cannot be omitted including the current scenario of growing SARS-CoV-2 cases, such hypothesis needs explorative studies [23, 31]. Provided circumstances, pigs commixing influenza virus vessels must be taken with care at any point in time, as they remain close to man and domestic-sylvatic cycles involving interaction with many wild animals, and then the situation can deteriorate [5]. However, for the time being, findings of [46] have not revealed paramount susceptibility of pigs to SARS-CoV-2.

Bats, civet and camels were the latest carriers of human CoV infections to animals [27]. Of the latest, bat and pangolins are considered to be the probable sources of inchoation of SARS-CoV-2 [47]. Still, genuine intermediate host and nature of emergence are yet to be explored. Two scenarios of the emergence of SARS-CoV-2 are being projected. First is that natural selection of viruses that may have occurred in an animal host afore transmission to humans and the second is that natural selection of viruses has occurred

in humans after zoonotic transmission [47]. Advanced studies involving cell culture or animal models can avail in elucidating these hypotheses [47,48].

SUPPORT OF VETERINARY LABORATORY

A risk assessment should be carried out with regard to the deferment of samples from human laboratories to veterinary laboratories, taking into account considerations such as the types of experiments and testing criteria, continuity and priority of business, scalability while maintaining quality standards, quality control, biosafety and biosecurity, data management and monitoring. Risk management strategies should aim to truncate identified risks. This process will fortify the development of the framework for coordination between veterinary laboratories and the public health workers. Ideally, testing protocols should be harmonized between public health and veterinary laboratories and should follow standard operating procedures.

Methods of detection of nucleic acids, such as RT-PCR in real time, are priority methods for detecting SARS-CoV-2 in humans. Supersession of ordinary RNA extraction processes using specimen heat inactivation is not recommended, as this can result in loss of sensitivity.

Antibody tests are not appropriate for early detection of SARS-CoV-2 (even they may be subsidiary to estimate possible protective immunity in individuals and to estimate population prevalence and immunity in surveillance studies). The efficacy of antigen tests is not yet completely established and they are not generally approved for routine diagnosis.

Laboratories should include reagents from various sources and countries to reduce the risks of supply chain interruptions (even this will pose problems in test validation). Laboratory examination of reagents on receipt should be performed to screen for contamination.

We can only use accredited diagnostic tests. If the test has been validated elsewhere, the veterinary laboratory performing the tests should still undergo verification. There are several commercial RT-PCR kits but not all have been validated. Commercial kits should be subject to testing before use and should be backed up by in-house assays in the event of supply chain dilemmas. Laboratories should preferably follow quality requirements e.g. or equipollent ISO/IEC 17025. However, many veterinary laboratories which could fortify the feedback are not accredited to ISO/IEC 17025 and would not be able to become accredited during a crisis. Such laboratories should perform their work in accordance with the principles of ISO/IEC 17025. Proficiency testing and inter-laboratory comparisons with public health laboratories may be habituated to demonstrate competency.

IMPORTANCE OF VETERINARY MEDICINE FOR VACCINE DEVELOPMENT

It is because of research in animal health and veterinary science that we know first of all that vaccines for coronavirus are achievable. Scientists have extended their scientific understanding of the virus over several years, and how to protect them. For example, it has been shown that the virus's "spike" proteins, which attach to cell receptors and allow the virus to infect and multiply, can be targeted using antibodies produced by the vaccination. For decades, the viruses isolated for vaccines against some animal diseases have remained relatively unchanged, indicating that the coronavirus does not mutate as rapidly as certain other viruses, such as flu, which require seasonal vaccines against the new circulating strains.

Veterinary medicine has also shown that effective vaccines can be adapted to function in a number of ways, avoiding disease by various means. For example, some livestock coronavirus vaccines are designed to produce antibodies in pregnant animals which can then be passed on to offspring susceptible to disease at birth. These virus-neutralizing antibodies produced through coronavirus vaccination play a critical role in disease prevention and control.

In other cases, coronavirus vaccines against different strains can be combined to provide broad protection. Veterinary vaccine delivery technologies could also be leveraged in the development of a human coronavirus vaccine. Some poultry coronavirus vaccines for example are given through drinking water or as a spray, thus providing a painless, simple and rapid form of immunization. This kind of local administration could be particularly effective against respiratory infections like Covid-19.

Due to their unique expertise, veterinary surgeons play critical roles at the center of human, animal, and environmental health diagrams in Venn. They have first-hand experience of successfully preventing animal coronaviruses by vaccination and many of the building blocks for a successful COVID-19 vaccination program already exist due to this expertise and observations. Through greater collaboration, scientists globally can rise to the challenge and complete this lifesaving mission. Humans and animals share so many of the same health and disease threats, so it stands to reason that they might also share the solutions.

COLLABORATION OF VETERINARIANS AND MEDICOS FOR PANDEMIC PREPAREDNESS

While the last influenza pandemic in 2009–10 is likely to be classified as mild in terms of pandemic morbidity and mortality [49], it should have been predicted that it would have served as a wake-up call for improved pandemic preparedness along with the SARS outbreak [32,50] irrespective of virus or zoonotic source. In addition, outbreaks of pandemic-potential animal disease, such as highly pathogenic avian influenza H5N1 viruses first identified in fatal human cases in 1997 [51], resulted in multiple poultry outbreaks and high human fatality rates, with human cases recorded from 17 countries in Asia, Africa, the Pacific, Europe and the Near East since November 2003 [52]. Therefore, the need for pandemic preparedness was generally not fully understood in the interpandemic decade since 2010, despite strong country support provided by the World Health Organization (WHO) for influenza pandemic preparation. Most preparation was therefore predicated on a pandemic caused by an influenza virus and not by viruses belonging to another genus or family. Now, though in the midst of the COVID-19 pandemic crisis, there is increasing awareness on national and international pandemic preparedness shortcomings.

As all pandemic viruses that emerged in the last century have their origin in the animal world and the ongoing changes in the respective interfaces between humans, animals and the environment have led to an increase in major predisposing factors that allow the emergence of zoonotic viruses as novel human pathogens, "peacetime" pandemic preparedness initiatives should adopt a "One Health approach" [53-55] (Figure 1).

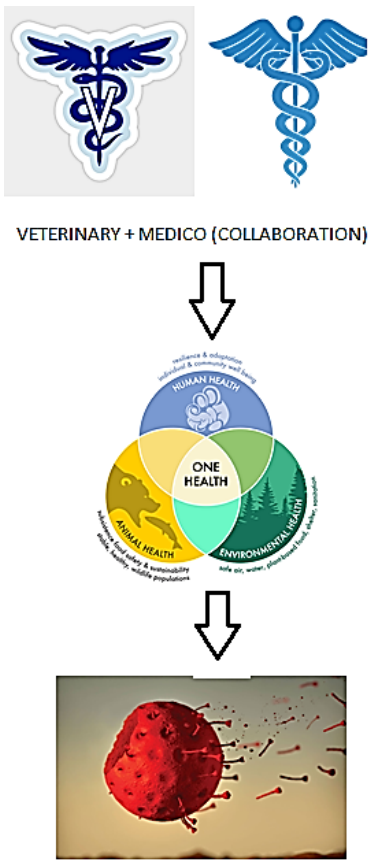

Figure 1: Graphical summary of one-health approach.

FUTURE RECOMENDATIONS

Like the Huanan South China Seafood Market, the live-animal markets will continue to serve as an ideal spot promoting inter-species interaction between wild and domestic animal species. Consequently, the risk of cross-species transmission of CoV infections at these hot spots is a problem for humans because of the adaptive genetic recombination that occurs in such viruses. The permanent ban on the trade of wild animals should not be enforced because it just moves the trade to the black market. Instead than going for the full ban, restricting the trade of wild animal species around the country is safer. For addition, the development of newer zoonotic pathogens such as SARS-CoV-2 is likely. Regional and international regulatory authorities also need to establish and enforce comprehensive frameworks for the management of diseases that effectively minimize the risk for human exposure to wild animals.

The outbreak of SARS-CoV-2 is yet another crucial example that shows the presence of a close but simple link between humans, animals, and the health of the world that could potentially lead to a deadly pandemic. The past decades have shown us the destructive capacity of many zoonotic coronavirus infections such as SARS, MERS and now SARS-CoV-2, which is calling for the introduction of One Health as a system to protect humanity from emerging pathogens in the near future.

Because all pandemic viruses that emerged in the last century have their origin in the animal world and the ongoing changes in the respective interfaces between humans, animals and the environment have led to an increase in major predisposing factors that allow the emergence of zoonotic viruses as novel human pathogens, "peacetime" pandemic preparedness initiatives should adopt a "One Health approach".

CONCLUSION

Due to their unique expertise, veterinary surgeons play critical roles at the center of human, animal, and environmental health diagrams in Venn. They have first-hand experience of using vaccination to successfully prevent animal coronaviruses. Scientists will rise to the task globally through greater cooperation and complete this lifesaving mission. As many of the same health and disease risks are faced by humans and animals, so it is fair for them to share the solutions too.

CONFLICT OF INTREST STATEMENT

The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-fi nancial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

DATA AVAILIBILITY STATEMENT

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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