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The Immunology System and the Coronavirus Way of Action in Human Organism

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Abstract

The occurrence of emerging Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV-2) disease (COVID-19) in Wuhan, the capital of Hubei, China, has been carried to global attention and declared a pandemic by the World Health Organization (WHO) on March 11, 2020. Various diagnostic kits to test for COVID-19 are available and several repurposing therapeutics for COVID-19 have shown to be clinically effective. The rapid genomic sequencing and open access data, together with advanced vaccine technology, for now, the only effective way of containing this viral outbreak is to implement all of the measures aimed at reducing transmission, including inhibiting people's movement and social activities. This work means to present the actually immunology defense against the virus infection as coronavirus and the most recent finds about it, as well as a treatment and mainly the vaccine. This work proposal is that more studies and researches will be made to solve the problem.

Keywords: Coronavirus; COVID-19; Immune response; Vaccine; Treatment

Introduction

The occurrence of emerging Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV-2) disease (COVID-19) in Wuhan, the capital of Hubei, China, has been carried to global attention and declared a pandemic by the World Health Organization (WHO) on March 11, 2020. Scientific developments since the pandemic of Severe Acute Respiratory Syndrome (SARS) in 2002~2003 and Middle East Respiratory Syndrome (MERS) in 2012 have speeded our accepting of the epidemiology and pathogenesis of SARS-CoV-2 and the advance of therapeutics to treat viral infection. As no specific vaccines are available for disease control, the epidemic of COVID-19 is self-importance a great threat for global public health [1]. The etiological agent of COVID-19 has been confirmed as a novel coronavirus, now known as Severe Acute Respiratory Syndrome Coronaviruses 2 (SARS-CoV-2). As COVID-19 has generated enormous human fatalities and serious economic loss pretense global threat, an understanding of the ongoing state and the development of policies to contain the virus's spread are immediately needed. Currently, several diagnostic tests for COVID-19 were accessible, and many therapeutics for COVID-19 have shown to be effective. In addition, global institutions and companies have begun to develop vaccines for the prevention of COVID-19 [2]. The rapid genomic sequencing and open access data, together with advanced vaccine technology, are expected to give us more knowledge on the pathogen itself, including the host immune response as well as the plan for therapeutic vaccines in the near future. This view may help in designing an immune mediation for COVID-19 in the close future [3].

The primary immune response is a positive response that leads to viral clearance in the majority cases. However, for reasons that are still unclear, the secondary immune response may be exaggerated and challenge tissue integrity, in some cases leading to multiple organs failure, acute respiratory distress syndrome and death. Though, for now, the only effective way of containing this viral outbreak and avoiding hundreds of needless deaths is to implement all of the measures aimed at reducing transmission, including inhibiting people's movement and social activities [4,5].

This work means to present the immunology defense against the virus infection as coronavirus and the most recent finds about it, as well as a treatment and mainly the vaccine.

Methods

We searched at PubMed with the words immunology, coronavirus and treatment and look for clinical study texts, free for access, published in the last 5 years, did in humans, written in English, and published in MEDLINE journal. In the works founded we selected only ones whose the mainly

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Table 1: The principal research finds in the articles founded in this research obtained from the abstract of the articles.

Article	Objective	Methodology	Results	Conclusions
Gorse et al. [6]	Study of human coronavirus and other virus-associated respiratory illnesses is needed to describe their clinical effects on chronically ill, older adults.	A prospective study during 2009 to 2013 clinically assessed acute respiratory illnesses soon after onset and 3 to 4 weeks later in patients aged 60 years with chronic lung and heart diseases (group 1) and healthy adults aged 18 to 40 years (group 2). Respiratory secretions were tested for nucleic acids of a panel of respiratory viruses. An increase in antibody titer was assessed for 4 coronavirus strains.	Virus-associated illnesses (29 [39.1%] of 74 illnesses in group 1 and 59 [48.7%] of 121 illnesses in group 2). Coronaviruses and enteroviruses/rhinoviruses illnesses; Virus co-infections occurred in 10 illnesses. Illnesses with 9 to 11 symptoms were more common in group 1 (17 [23.0%]) than in group 2 (15 [12.4%]) (P<0.05). Coronavirus associated illnesses (percent of illnesses, group 1 *vs.* group 2) were characterized by myalgias (21% *vs.* 68%, P<0.01), chills (50% *vs.* 52%), dyspnea (71% *vs.* 24%, P<0.01), headache (64% *vs.* 72%), malaise (64% *vs.* 84%), cough (86% *vs.* 68%), sputum production (86% *vs.* 60%), sore throat (64% *vs.* 80%), and nasal congestion (93% *vs.* 96%).	Respiratory illnesses were commonly associated with coronaviruses and enteroviruses/rhinoviruses affecting chronically ill, older patient's more than healthy, young adults.
van Beak et al. [7]	Data on the relative contribution of influenza virus and other respiratory pathogens to respiratory infections in community-dwelling older adults (≥ 60 years) are needed.	A prospective observational cohort study was performed in the Netherlands during 2 winters. Nasopharyngeal and oropharyngeal swabs were collected during Influenza-Like Illness (ILI) episodes and from controls. Viruses and bacteria were identified by multiplex ligation-dependent probe amplification assay and conventional bacterial culture.	The ILI incidence in the consecutive seasons was 7.2% and 11.6%, and influenza virus caused 18.9% and 34.2% of ILI episodes. Potential pathogen were detected in 80% of the ILI events with influenza virus, coronaviruses, rhinoviruses, human metapneumovirus, respiratory syncytial virus, parainfluenza viruses, and *Haemophilus influenzae* being the most common. Influenza vaccination reduced influenza virus infection by 73% (95% confidence interval [CI], 26%-90%) and 51% (95% CI, 7% to 74%) in ILI patients. However, ILI incidence was similar between vaccinated (7.6% and 10.8%) and nonvaccinated (4.2% and 11.4%) participants in 2011-2012 and 2012-2013, respectively (*P*>0.05).	Influenza virus is a frequent pathogen in older adults with ILI. Vaccination reduces the number of influenza virus infections but not the overall number of ILI episodes: other pathogens fill the gap. We suggest the existence of a pool of individuals with high susceptibility to respiratory infections.
Beigel et al. [8]	Report the safety of a fully human polyclonal IgG antibody (SAB-301) produced from the hyperimmune plasma of transchromosomic cattle immunized with a MERS coronavirus vaccine.	healthy participants aged 18-60 years who had normal laboratory parameters at enrolment, a body-mass index of 19-32 kg/m^2, and a creatinine clearance of 70 mL/min or more, and who did not have any chronic medical problems that required daily oral medications, a positive rheumatoid factor (≥ 15 IU/mL), IgA deficiency (<7 mg/dL), or history of allergy to intravenous immunoglobulin or human blood products. Participants were randomly assigned by a computer-generated table, made by a masked pharmacist, to one of six cohorts (containing between three and ten participants each). Cohorts 1 and 2 had three participants, randomly assigned 2:1 to receive active drug SAB-301 *vs.* normal saline placebo; cohorts 3 and 4 had six participants randomized 2:1; and cohorts 5 and 6 had ten participants, randomized 4:1. Participants received 1 mg/kg, 2·5 mg/kg, 5 mg/kg, 10 mg/kg, 20 mg/kg, or 50 mg/kg of SAB-301, or equivalent volume placebo (saline control), on day 0, and were followed up by clinical, laboratory, and pharmacokinetic assessments on days 1, 3, 7, 21, 42, and 90. The primary outcome was safety, and immunogenicity was a secondary outcome. We analyzed the intention-to-treat population. This trial is registered with Clinical Trials.	Between June 2, 2016, and Jan 4, 2017, we screened 43 participants, of whom 38 were eligible and randomly assigned to receive SAB-301 (n=28) or placebo (n=10). 97 adverse events were reported: 64 adverse events occurred in 23 (82%) of 28 participants receiving SAB-301 (mean 2·3 adverse events per participant). 33 adverse events occurred in all ten participants receiving placebo (mean 3·3 adverse events per participant). The most common adverse events were headache (n=6 [21%] in participants who received SAB-301 and n=2 [20%] in those receiving placebo), albuminuria (n=5 [18%] *vs.* n=2 [20%]), myalgia (n=3 [11%] *vs.* n=1 [10%]), increased creatine kinase (n=3 [11%] *vs.* 1 [10%]), and common cold (n=3 [11%] *vs.* n=2 [20%]). There was one serious adverse event (hospital admission for suicide attempt) in one participant who received 50 mg/kg of SAB-301. The area under the concentration-time curve (AUC) in the 50 mg/kg dose (27 498 µg × days per mL) is comparable to the AUC that was associated with efficacy in a preclinical model.	Single infusions of SAB-301 up to 50 mg/kg appear to be safe and well tolerated in healthy participants. Human immunoglobulin derived from transchromosomic cattle could offer a new platform technology to produce fully human polyclonal IgG antibodies for other medical conditions.
Hirsch et al. [9]	It will describe the frequency of influenza virus infections among HCP, identify predictors of vaccine acceptance, examine how repeated influenza vaccination may modify immunogenicity, and evaluate influenza vaccine effectiveness in preventing influenza illness and missed work.	The study will run for at least 3 years and will follow approximately 2000 HCP (who are both employees and members of Clalit Health Services [CHS]) with routine direct patient contact. Blood samples are collected at enrollment and at the end of influenza season; HCP who choose to be vaccinated contribute additional blood one month after vaccination. Respiratory specimens from self-collected nasal swabs are tested for influenza A and B viruses, respiratory syncytial virus, human metapneumovirus, and coronaviruses using validated multiplex quantitative real-time reverse transcription polymerase chain reaction assays. The hemagglutination inhibition assay will be used to detect the presence of neutralizing influenza antibodies in serum.	The use of mixed methods, including laboratory, clinical and epidemiological quantitative data, and in-depth qualitative interviews, creates a comprehensive approach, which is particularly important when trying to understand issues of influenza vaccine compliance and hesitancy. Finally, the study cohort includes several unique sub-studies.	SHIRI will expand our knowledge of the burden of respiratory viral infections among HCP and the effectiveness of current and repeated annual influenza vaccination in preventing influenza illness, medical utilization, and missed workdays among HCP who are in direct contact with patients.

Docherty et al. [10]	To characterize the clinical features of patients admitted to hospital with Coronavirus Disease 2019 (COVID-19) in the United Kingdom during the growth phase of the first wave of this outbreak	208 acute care hospitals in England, Wales, and Scotland between 6 February and 19 April 2020. A case report form developed by ISARIC and WHO was used to collect clinical data. A minimal follow-up time of two weeks (to 3 May 2020) allowed most patients to complete their hospital admission.	The median age of patients admitted to hospital with COVID-19, or with a diagnosis of COVID-19 made in hospital, was 73 years (interquartile range 58-82, range 0-104). More men were admitted than women (men 60%, n=12 068; women 40%, n=8065). The median duration of symptoms before admission was 4 days (interquartile range 1-8). The commonest comorbidities were chronic cardiac disease (31%, 5469/17 702), uncomplicated diabetes (21%, 3650/17 599), non-asthmatic chronic pulmonary disease (18%, 3128/17 634), and chronic kidney disease (16%, 2830/17 506); 23% (4161/18 525) had no reported major comorbidity. Overall, 41% (8199/20 133) of patients were discharged alive, 26% (5165/20 133) died, and 34% (6769/20 133) continued to receive care at the reporting date. 17% (3001/18 183) required admission to high dependency or intensive care units; of these, 28% (826/3001) were discharged alive, 32% (958/3001) died, and 41% (1217/3001) continued to receive care at the reporting date. Of those receiving mechanical ventilation, 17% (276/1658) were discharged alive, 37% (618/1658) died, and 46% (764/1658) remained in hospital. Increasing age, male sex, and comorbidities including chronic cardiac disease, nonasthmatic chronic pulmonary disease, chronic kidney disease, liver disease and obesity were associated with higher mortality in hospital.	ISARIC WHO CCP-UK is a large prospective cohort study of patients in hospital with COVID-19. The study continues to enroll at the time of this report. In study participants, mortality was high, independent risk factors were increasing age, male sex, and chronic comorbidity, including obesity. This study has shown the importance of pandemic preparedness and the need to maintain readiness to launch research studies in response to outbreaks.
Huang et al. [11]	Initial results on Chloroquine therapy of COVID-19 patients	Patients were then randomized into two groups: 10 patients, including 3 severe and 7 moderate cases, were treated with Chloroquine 500 mg orally twice daily for 10 days; 12 patients, including 5 severe and 7 moderate cases, were treated with Lopinavir/Ritonavir 400/100 mg orally twice daily for 10 days.	One patient in the Chloroquine group became SARS-CoV-2 negative after treatment for only 2 days. There were then steady increases in the number of patients turning negative, cumulating at Day 13 when all of the Chloroquine-treated patients became negative. Patients in the Lopinavir/Ritonavir group only became SARS-CoV-2 negative after 3 days of dosing, and 11 out of 12 turned negative at Day 14.	Comparing to the Lopinavir/Ritonavir group, the percentages of patients who became SARS-CoV-2 negative in the Chloroquine group were slightly higher at Day 7, Day 10, and Day 14. These results suggest that Chloroquine has slight advantage over Lopinavir/Ritonavir based on RNA tests. In sum, our preliminary results suggest that Chloroquine could be an effective and inexpensive option among many proposed therapies, e.g. Lopinavir/Ritonavir.

research is doing with coronavirus and the treatments used to give the patients most quality of life.

Results

We founded 6 publications according the terms of the research and are showed in the tables (Table 1).

Discussion

The study of Gorse et al. [6] describes the symptoms, greater severity, medical burden, and seasonality of acute respiratory illness in older adults with underlying cardiopulmonary diseases compared with young healthy adults. Coronavirus and enteroviruses/rhinoviruses were the most common viruses associated with illness. The most common symptoms associated with but not unique to coronaviruses were chills, headache, malaise, cough, sputum production, sore throat, and nasal congestion; dyspnea was more common in the older group, and myalgia was more common in the younger group. Non-coronavirus, virus-associated illnesses, which were predominantly enterovirus/rhinovirus infection, commonly manifested headache, myalgia, malaise, cough, sputum production, sore throat, and nasal congestion. Older, chronically ill patients experienced more severe and prolonged disease, and were more likely to receive treatment with antibiotics and prednisone with coronavirus and other virus-associated illnesses. The results of more sensitive virus nucleic acid detection techniques could help clinicians with diagnosis and encourage the judicious use of antimicrobials. Kadkhoda [12] describe that additional corroborative research is urgently needed to encounter why progressive age is a major risk factor for COVID-19 and whether immunopathomechanisms can possibly be attached early enough to avoid irreversible significances. This may be pioneering and would not only change the current individual patient organization but also potentially inform practical vaccine design and sanctions as was as dengue virus vaccination. The suggestions of Antibody-Dependent Enhancement (ADE) will be massive if IgG serology is used to determine immune status for health care workers, as a confident result does not necessarily mean one is immune to COVID-19 (even with a test specificity of 100%). More importantly, ADE may cause damage if plasma from clinically resolved patients is used for treatment. A very careful equilibrium between risks and benefits proven through large multicenter randomized controlled hearings will provide answers to all these questions.

Van Beek et al. [7] show that influenza virus caused between 18.9% and 34.2% of Influenza-Like Illness (ILI) cases in community-dwelling older adults aged ≥ 60 years in 2 influenza seasons in the Netherlands, leaving the remainder caused by other pathogens. They also show that influenza vaccination was effective in reducing the incidence of influenza virus infections but did not reduce the ILI incidence, which may have important public health and healthcare consequences. Their data will also help to better inform the public what to expect from influenza vaccination and how it will not protect against all cases of ILI, popularly seen as “flu”. Raoult et al. [13] shows that despite the fact that SARS-CoV-2 appears much less virulent than SARS-CoV-1 and MERS-CoV, it is associated with significant mortality among susceptible individuals with comorbidities. Moreover, the buildup and scaremongering going viral on mass news and social media, forecasting the beginning of a new fatal pandemic, are urging global hysteria. Thus, the current COVID-19 epidemic is resulting in a social somewhat than a viral disaster. Whereas the future evolution of this epidemic remains random, classic public health policies must follow rational designs. The growth of the response cannot be consistent as ‘one size fits all’ but should be personalized based on the local evolution of the epidemic and the socio-economic sceneries involved.

Indeed, the appearance of yet another global epidemic reveals the permanent challenge that infectious diseases represent for humanity and underlines the need for global cooperation and readiness, even during inter-epidemic stages.

For Beigel et al. [8], the study made by them is the first study to show the safety, acceptability, and pharmacokinetics of a new therapeutic for MERS, as well as for this new source of fully human IgG produced in transchromosomic livestock. The information preserved in this study suggests that SAB-301 is benign and well accepted at hypothetically therapeutic experiences. Additional clinical investigation of SAB-301 for the treatment of MERS is necessary. For Gasparyan et al. [14] this pandemic due to COVID-19 requires assembling all available incomes for covering the virus range. Such defensive events can primarily save lives of high-risk persons, such as children, pregnant women, medics, patients with original immunosuppressive and other chronic diseases, and the mature people. Seeing all safety issues, high-risk populations should experience regular vaccinations to produce their immunity and actively antibodies that may react with SARS-CoV-2. Assumed the limitations of the cross-reactivity, particularly collapse of active immune response over time and with aging, passive antibody therapy can be indicated in subjects with early symptoms of COVID-19 and those with recent associates with patients.

In this work Hirsch et al. [9] suggest four limitations a virus protocol. First, the ability to simplify vaccine success findings from the study years to the potential protective value of a vaccine package may be limited. The success of the vaccine depends in part on the types of viruses circulating and the antigenic and genetic counterpart between vaccine components and circulating strains in a given year. Second, cautions in understanding self-reported information, given potential partialities in recall and self-presentation. Third, although the random stratified sampling design intentionally includes cohort of Healthcare Personnel (HCP) with a mixture of characteristics and work responsibilities, there are relatively few HCP in some of the strata. Fourth, during the third wave of recruitment accept volunteers, regardless of age, profession, or vaccine status, which can present a sampling bias. However, characteristics of these volunteers will be associated those of participants engaged during the first two waves in order to evaluate potential differences between the groups. Amanat and Krammer [15] proposed that considering the profound drive stock markets have taken in current weeks and given the expected effect of a pandemic on the economy, funding for vaccine production arrangement that would allow a rapid response to developing viruses looks like an excessive investment. Such investments have infrequently been made in the past, except for H5 and H7 subtypes of influenza strains. Now would be the right time to reflect investing in vaccines against the viruses that can main to loss of human lives and burden the global economy. For SARS-CoV-2, vaccines potency comes very late to affect the first trend of this pandemic. However, they force be useful if supplementary waves occur advanced or in a post-pandemic situation in which SARS-CoV-2 continues as a seasonal virus.

Docherty et al. [10] classify sectors of the population that are at greatest risk of a deprived consequence, and report the use of healthcare resources. Those patients with covid-19 who were admitted to hospital two weeks before data removal, less than half have been quitted alive and a quarter have died. 17% of patients admitted to hospital requisite critical care. This group studied has shown the importance of onward planning and investment in readiness studies. It is necessary to understanding the impact of covid-19 and focus on improving patient outcomes. Fathizadeh et al. [16] reminds that COVID-19 is now a global health threat and the number of confirmed reports of new cases and deaths is increasing every day. The surviving of virus in the air and on surfaces for several hours to several days, and in addition the observation of individual hygiene tips such a regular hand washing and avoiding contact, use of negative pressure ventilation in hospital sectors, open space, the face mask wearing, in the crowded areas, disinfection of frequently touched surfaces is required to reduce SARS-CoV-2 spreading through of aerosol. However, further research needs to be done to increase knowledge about the structural and pathogenic features of SARS-CoV-2 and to find effective therapies and vaccines to control this disease.

Huang et al. [11] suggested that Chloroquine could be an effective and low-cost option among several proposed treatments, as Lopinavir/Ritonavir. Considering the severe epidemic and short supply of medical resource, the study was limited by small sample size. Although their study is fairly preliminary, it has some consequences for the epidemic to the world. The hope is that this work may encourage larger scale randomized trials to fully estimate this old drug against COVID-19. In the nonappearance of a specific cure, old drugs such as Chloroquine may be re-presented to fight this novel disease and save individual lives worldwide. COVID-19 is a disease mostly manifested as fever and pneumonia, anti-viral and respiratory helpful therapies are the conventional of treatment for severe cases. As cytokine tempest occurs in grave patients, which mains to acute respiratory pain syndrome and multiple organ injury, and even death, anti-inflammation action may be applied. However, given the viral nature of the COVID-19 cytokine blizzard, and considering a substantial impairness of host immune system in austere cases, it is critical to balance the risk and benefit ratio before starting anti-inflammatory therapy. In addition, a timely anti-inflammatory treatment started at the right window time is of essential importance and should be personalized in individual patient to realize the most satisfactory effects [17].

Conclusion

Despite all researches done in the world we don't know how to treat this virus disease. The advantages in immunology field, as vaccines, antibodies, medicines, and different treatments are few sufficient to solve the problem. Research will take in the entire world to find out the real and affect way to treat this virus disease or to immunize individually against it.

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