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The Impact of Smoking on COVID-19

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Abstract. In 2019, the spread of a global pandemic was disturbing. Its name was COVID-19, the novel coronavirus. So far, more than 18 million patients have died. Although countries have established relatively mature response plans, the disaster is not completely over, and the era we are living in is called the post-pandemic era. Therefore, the study of COVID-19 is no longer limited to medical and biological research. It has penetrated our life. The problem we need to solve is not only how to cure it and protect it, but also more aspects of research. The same behavior that causes damage to the lungs is smoking, and the number of smokers worldwide is no longer small, for whom the act of smoking has become a normal part of life. So, the relationship between COVID-19 and smoking raises more important questions: does smoking affect the spread of COVID-19? Does smoking increase the risk of COVID-19? Does smoking affect treatment for COVID-19? The paper adopts the research method of literature review, summarizes the scientific literature of others, and involves knowledge of biology, statistics, and medicine. Finally, it is concluded that smoking exacerbates the spread of COVID-19, harms patients, and hinders treatment.

Keywords: COVID-19, smoking, epidemic, human health, post-pandemic era

1. Introduction

According to statistics, even under different national controls, the global smoking population still accounts for 20% [1]. That means one smoker for every five people. Leaving aside the dangers of smoking, the size of the numbers is surprising. So, in the context of the pandemic, it is especially important to study the impact of smoking on COVID-19. This paper investigates the impact of smoking on COVID-19. Specifically, from three aspects of transmission, patients, and treatment analysis. In the context of smoking and COVID-19 transmission, biological and epidemiological knowledge are involved. Smoking and COVID-19 treatment, related to medical and pathological knowledge. The relationship between smoking and COVID-19 patients is not only medical but also in the humanities and psychological knowledge. So, talking about the correlation between smoking and COVID-19 shows not only thinking about the post-pandemic era but also the many areas of knowledge that are linked to COVID-19, making COVID-19 less foreign.

2. Smoking's impact of transmission

Considering the impact of smoking on the spread of COVID-19, it is important to first understand how COVID-19 is transmitted. Thushara et al. found that COVID-19 is not only spread by droplets but also

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has indirect modes of transmission, such as pollutants and aerosols, by observing the analogy with the SARS-CoV-2 virus [2]. This mode of transmission can make people who smoke more vulnerable to COVID-19 in two ways.

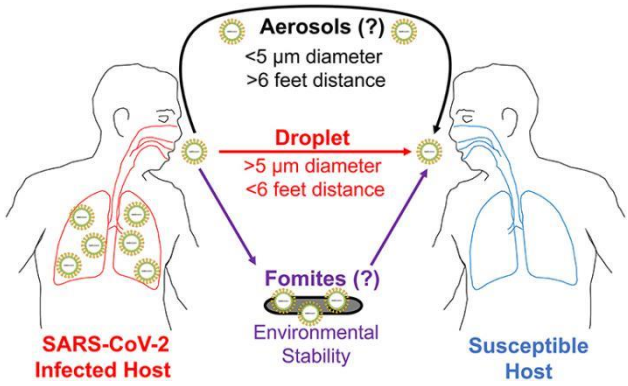

Figure 1. COVID-19 potential modes of transmission [2].

The first is the spread of COVID-19 by respiratory droplets. Whether it's e-cigarettes or traditional cigarettes, the act of smoking is done by breathing. A smoker's nose and mouth must be completely exposed to the air. The known safe distance to prevent the spread of COVID-19 droplets is 3-6 feet [2]. This means that smoking can have a serious impact on transmission even at a distance of three feet because people who smoke in large groups often have short distances to communicate normally. And smoking is not wearing masks and other protective equipment. Even in a well-ventilated outdoor environment, COVID-19 can survive for 2-3 hours. Communicating with unprotected smokers is a potential risk for droplet transmission. During the breathing process, smokers may release the virus, which is the main cause of droplet transmission. The symptoms of COVID-19 patients are fever and cough. In addition, the closure of smoking rooms at major airports during the pandemic is also evidence of efforts to prevent the spread of COVID-19. The most important mode of transmission of COVID-19 is droplet transmission, and smoking behavior is the cause of droplet transmission.

Then there are the indirect transmission factors of COVID-19. COVID-19 has the function of attachment. Arun's research shows that air pollution index and temperature both affect survival with COVID-19. The air pollution index in the experiment is expressed according to the amount of particulate matter in the air. Studies have shown that when there are more particles in the air, viruses are more likely to attach, which means they are more likely to survive. Similarly, lower or higher temperatures are more conducive to virus survival [3]. Unfortunately, when you smoke, the smoke is rich in particles, and the temperature of the butt is 170°C-300°C and the center temperature can reach 500°C-800°C. So, smoking increases the particulate content of the air and affects the room temperature. This makes it easier for the virus to attach, leading to easier transmission and COVID-19. Although there are no definitive experiments to show that COVID-19 is more easily attached to particles produced by cigarette burning, the spread of COVID-19 is greater when you smoke without protection, whether indoors or outdoors. Cigarettes may not be a risk factor but they are a significant contributor. Assuming that the smoker is alone, there is no transmission to the surrounding population, whereas the activity of smoking requires breathing. If a smoker is infected with COVID-19, it is easier for him or her to expel the virus because there is no protective gear. The virus he or she excretes stays in the particles longer. So, the size of the crowd doesn't change the fact that smoking helps spread the virus.

Based on these conclusions, smoking is conducive to the spread of COVID-19. Breathing causes droplets to spread, and the transmitted virus is more likely to attach itself to airborne particles, where it lives for a long time, putting anyone who passes through it at risk of getting sick. So, smoking makes it easier for viruses to attach, and smoking without protection makes it easier to release viruses.

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3. Smoking's impact on patients

Smoking causes 8 million deaths a year from cardiovascular disease, lung disease, cancer, diabetes, hypertension, etc. [4]. As COVID-19 is also harmful to people's health, we need to pay attention to whether it will cause more serious harm with the substances in cigarettes. The same thing as smoking and COVID-19 is the direct damage to the lungs. COVID-19 is a disease in which the virus enters a patient's lungs, leading to an uncontrolled immune response in the lungs. Making the patient appear to have fever, inflammation, and other symptoms is a new type of pneumonia [5]. And lung damage from cigarettes increases over time, but not as rapidly as COVID-19. Nicotine, carbon monoxide, and various combustion chemicals in cigarettes cause irreversible damage to the body, including a variety of carcinogenic factors. Regular smokers are at risk of cancer and cardiovascular disease [6]. The new cigarettes, called e-cigarettes, do not produce the same chemicals as cigarettes burn. However, e-liquids contain nicotine, flavorings, and propylene, all of which can harm the lungs and pose the same risk as smoking [7].

The first step is to determine how cigarettes and COVID-19 patients are affected from a biological perspective. In more detail, smoking behavior increases the risk of respiratory infections and is associated with infected individuals. Compared with non-smokers, acute or chronic smokers may develop infections, tuberculosis, bacterial pneumonia, and ARDS with severe complications and multiple comorbidities, including emphysema, atherosclerosis, and immune dysregulation, thus contributing to the onset and progression of COVID-19 [8]. These symptoms are different from the symptomatic effects of COVID-19, and no association between smoking and COVID-19 has been found in other regions. In Haider's study, they recruited 11,701 COVID-19 patients, including 2,952 smokers. The covariates were age, sex, nationality, and other conditions. In terms of results, Haider found that smoking symptoms were not associated with the chills and abdominal pain of COVID-19, but with the common cough, fever, and headache [8]. The results were significantly influenced by age, indicating that older people with COVID-19 were more likely to be affected by smoking. This is because, with the increase of age, the body's resistance and immunity begin to weaken, and the body's organs also become weaker. At the same time, the longer the smoking age of patients, the greater the harm of cigarettes to the body, and the more the correlation between COVID-19 and smoking can be seen in the case that all aspects are weakened [8]. However, this conclusion is partial and cannot show an association between smoking and COVID-19 in patients of all ages. From a microscopic biological perspective, smoking will have an impact on COVID-19 patients. An increase in the peripheral nicotinic acetylcholine receptor (nAChR) in smokers makes them more susceptible to COVID-19. This is just one example from Haider's experiment. Smoking also affects the degeneration of various substances in the body, leading to an increased risk of COVID-19 [8]. So biologically speaking, smoking makes you more likely to get sick, and it makes you worse.

Statistically speaking, smoking directly affects the incidence of COVID-19. According to WHO statistics, only 1.4-18.5% of COVID-19 patients in the 27 studies smoked, only 7.6% of 2986 patients, and 6.5% of 5960 patients. This data does not show a strong correlation between the number of smokers and COVID-19 patients [4]. This result is also associated with a large COVID-19 patient base, as the denominator is larger in such a large base, resulting in a small proportion of smokers. And the influence of covariates such as age and sex cannot be excluded. The same conclusion was found in the Carolina study, in which only 5.2% of the 5224 patients were active smokers [9]. However, it is worth noting in the study that although the proportion of smokers was weakly correlated with the number of patients, the multivariate analysis by Carolina concluded that the negative effect of smoking would affect the physical condition of COVID-19 patients [9]. Therefore, it is not possible to obtain the degree of influence of smoking on the treatment of COVID-19 from statistics.

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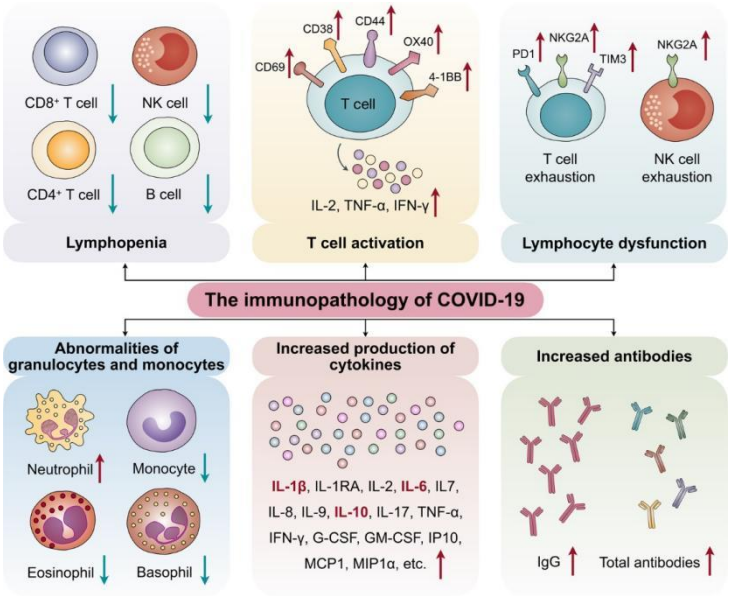

Figure 2. The immunopathology of COVID-19 [5].

4. Smoking's effects on treatment

The treatment for COVID-19 is the most important right now, and being able to treat COVID-19 marks a victory over COVID-19. Known treatments include vaccinations, ventilators, and drugs. But there is no single cure for COVID-19. There is no complete solution to COVID-19, but the search to prevent and treat COVID-19 must not stop. Now that COVID-19 cannot be completely solved, discussing the impact of various substances on COVID-19 treatment is what needs to be done in the post-pandemic era. There have been rumors that tobacco and alcohol can cure COVID-19. After all, tobacco and alcohol are all around us. Whether these items can affect the treatment of COVID-19 is up for debate.

Vaccination is currently the most important prevention and treatment for COVID-19. Ferrara et al., by experimentally testing the BNT162b2 mRNA vaccine and cigarettes, analyzed the results from the serum of the vaccine-induced IgG titer stored in smokers and non-smokers in differences. This difference remained after controlling for covariates such as age, sex, and history of infection [10]. Yushi came to a similar conclusion. He found that the most important factors affecting antibody levels were age and smoking habits, with smokers having significantly lower levels of antibodies than non-smokers, and suggested that quitting smoking could improve the effectiveness of vaccination [11]. In conclusion, smokers will cause adverse reactions to the COVID-19 vaccine and weaken the effect of the vaccine, so smoking hurts vaccine therapy.

Smoking affects the proteins in the patient's body. According to Vivek, smoking modulates ACE-2 in COVID-19. Ace-2 acts as a protein carrier on the cell surface, and smoking can induce ACE-2 protein as a vector to facilitate the invasion of COVID-19, making patients more susceptible to COVID-19. And drugs cannot control the induction, nor can current molecular medicine go far enough to alter proteins in the body. Smoking also modulates proinflammatory cytokines in COVID-19, which means patients are more prone to inflammation and cell death [12]. Smoking leads to excessive accumulation of immune cells in the lungs of patients, resulting in excessive production of proinflammatory cytokines, which eventually damage the lung structure and lead to more severe inflammation. However, nicotine in tobacco can play a regulatory role in COVID-19 patients. Nicotine is a cholinergic anti-inflammatory agonist, and medicinal nicotine can alleviate the invasion of the COVID-19 virus [12]. However, since tobacco contains many harmful substances besides nicotine, it is not a cure at all, but a harmful substance that patients should stop using. Smoking cessation reduces the risk and likelihood of developing COVID-19, and further research is needed on the use of nicotine as a medical treatment. Do not choose controversial items when there are clear treatment options for COVID-19.

There are also negative effects of e-cigarettes on COVID-19. Richard concludes that there is currently no evidence that e-cigarettes have an impact on the treatment of COVID-19 [13]. But logically, the effects of e-cigarettes are similar to those of cigarettes, and again, these risks are related to age, composition, and frequency of use. E-cigarettes contain fewer harmful chemicals than traditional cigarettes, but no less nicotine. And there are more unknown chemicals in e-cigarettes, such as flavorings and flavors. Further research is needed to determine whether the substances produced by the heating of the nebulizer will act as resistance to COVID-19 treatment.

5. Conclusion

This paper takes a holistic look at the impact of cigarettes on COVID-19. The impact is divided into three aspects: the impact of cigarettes on COVID-19 transmission; the impact of cigarettes on COVID-19 patients; and the impact of cigarettes on COVID-19 treatment. The conclusion that cigarettes can increase the spread of COVID-19 is based on the substance of cigarettes and the transmission characteristics of COVID-19. It discusses the substances and environment produced when smoking, which can contribute to the spread of COVID-19 according to both routes of transmission. As for the impact of cigarettes on people with COVID-19, smoking will always affect human health, even if they are not people with COVID-19. This part of the research is based on biomedical and statistical perspectives. From the perspective of biomedicine, it can be concluded that smoking is not good for the health of patients and will aggravate the disease. However, in the total patient statistics, the correlation between smoking and COVID-19 is low, and it is impossible to draw an inevitable association. Finally, cigarette smoking is resistant to COVID-19 treatment. For the current main treatment of COVID-19, cigarette smoking affects not only the treatment of the COVID-19 vaccine but also the treatment of patients' lungs. In addition, many harmful effects of cigarettes cannot be solved medically at present. The best advice for COVID-19 patients is to quit smoking.

This paper is based on a lot of research, so there are limitations in the data conclusions. There are too few e-cigarette statistics to draw any conclusion. In the future, we hope to collect more data on these aspects and draw more detailed conclusions. In addition, it is interesting that nicotine can treat and alleviate COVID-19. The exploration of COVID-19 cannot be satisfied with this, especially in the current post-pandemic era, when public attention to COVID-19 is declining, but new patients are growing all the time. People all hope to solve the problem of COVID-19 as soon as possible and step into the next era of human development. After all, in the face of a global disaster, the development of science and technology and the economy will be affected.

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