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Review

Handwashing in against of coronavirus disease 2019 infection

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Abstract

Coronavirus disease 2019 (COVID-19) was found first in Wuhan (China), which was considered as an infectious disease caused by severe acute respiratory syndrome coronavirus 2. Hence, in order to prevent an increasing infectious disease risk, current management strategies against COVID-19 should strictly comply for stopping-up the spread of COVID-19 outbreak. There is a major challenge in the timely diagnosis (by kits, etc.) to prevent COVID-19 infection outbreak until proper drugs or vaccines for treating COVID-19 patients are introduced. Therefore, it is essential to demand personal protective manners for each person in against of COVID-19 infection. In this article, the symptoms of COVID-19 and the effect of handwashing in against of COVID-19 are mentioned, as well as its benefits in the COVID-19 infection prevention are understood more clearly.

Introduction

Currently, the coronavirus disease 2019 (COVID-19) outbreak is a major problem worldwide. Along with the influenza virus disease and other coronavirus diseases (H1N1, SARS, and MERS) outbreak all around the world, it threats human health and turns to a major challenge for both community and clinicians.[1-7] While human-to-human transmission of the influenza virus is principally caused by the aerosol spread, person-to-person transmission of the influenza virus and coronaviruses by hand-contact is potentially important too.[8-10] Specifically, healthcare workers are at a higher risk of infection due to persistent contact with COVID-19 patients, turning them to carriers which could result in spreading the infection to other individuals, if the preventive manners are not maintained properly.[11,12] Furthermore, in the children care center, acute respiratory infections commonly occur in children who take care of the child; so preventing or limiting the human-to-human transmission of this disease depends on the actions of child care staff.

So far, personal protective manners are considered as one of the non-pharmaceutical interference for protection of human, because of shortages and delays in the development of drugs and vaccines. As such, appropriate handwashing becomes one of the personal protective manners, which could reduce the risk of transmission.[13-17] It has an important role in the transmission risk in both healthcare workers and public population; as neglecting appropriate handwashing while caring for patients with COVID-19 can lead to considerable transmission. Thus, it is really useful to strictly perform and clearly understand its role in prevention of COVID-19 infection. The current information and guidelines on the role of handwashing in the prevention of COVID-19 infection seem unclear. Hence, the aim of this article is to review the symptoms of COVID-19 and the effect of handwashing in against of COVID-19.

Symptoms of COVID-19

A new virus was first called the 2019 novel coronavirus (2019-nCoV), then it was termed as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), because of its similarities to the one that caused the SARS outbreak. 2019-nCoV is responsible for the emerging respiratory disease outbreak, called COVID-19. The COVID-19 is also similar to the SARS, which is known as a single-stranded RNA virus.[18,19] Currently, the COVID-19 can occur in humans with common symptoms, such as fever, cough, and breathing difficulties. For further serious cases, it can result in severe pneumonia, kidney failure, and even death especially in older adults and patients with underlying medical diseases.

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For typical viral pneumonia, the multifocal ground-glass changes in the chest and lung computed tomography (CT) scans are examined to follow and determine the status of the disease, such as the CT images of a 33-year-old woman shown in Figure 1.[20-26] Specifically, CT images (Figure 1a) present a bilateral ground-glass opacity in lungs, while the sputum analysis of the patient was positive for COVID-19. In Figure 1b, progressive ground-glass opacity is evident in the posterior segment of the right upper lobe and the apical posterior segment of left superior lobe after three days of follow-up, which indicates a poor progression in patients' general conditions as the progressive pulmonary opacities are found at the repeated CT image. As such, the threat of COVID-19 becoming a pandemic seems to be a serious danger to the community health.[25,27,28] Although human-to-human transmission of 2019-nCoV is essentially by aerosol spread,[29] the transmission of the virus on the hands is also of a potential importance. Generated droplets in coughing, sneezing, or speaking are too heavy to suspend in the air, which makes them promptly fall on surfaces (or on the floor). Thus, people could be infected by touching the contagious surfaces and then touching their face, nose, eyes or mouth with the unwashed hand. Besides, people should practice by coughing into a flexed elbow.

Effect of handwashing in against of COVID-19

Regarding the current status, the emergence of COVID-19 pandemic continues as the number of infected individuals increases due to the absence of suitable drugs and vaccines. Thus, these factors support the use of non-pharmaceutical public health interventions to hinder the human-to-human transmission of the COVID-19. Also, several clinical trials were carried out to evaluate potential measures. Therefore, the best way to prevent and slow down transmission is protecting ourselves by the regular handwashing of with soap and water (or warm water)-based handwashing, or alcohol-based hand sanitizer, as well as avoiding to touch face, eyes, nose or mouth with unwashed hands. Moreover, the transmission of the COVID-19 could relate to touching the contagious surfaces and then touching face, nose, eyes or mouth with the unwashed hand.

Although there are several performed trials on handwashing[30-32] among both community and clinicians, the effectiveness of handwashing in against of COVID-19 infection is not clearly understood yet. Handwashing is identified as an effective measure in reducing the influenza virus infection in the health centers[33-35] and several other settings (school, community, and military settings).[32,36,37] However, the results of compliance and the effectiveness of these interventions in the community are less known (see Table 1).[36-40] Recently, specific studies have been performed on the effectiveness of handwashing-based COVID-19 protection measures. However, it is still unclear whether handwashing by soap is more effective or handwashing by alcohol. Additionally, providing a free supply of soap to poor households around the world is truly expensive. Hence, for the health community, the identification of cost-effective strategies towards handwashing seems like a challenge. For instances, Levy et al[41] examined factors related to households with an infected child, resulting in that the influenza virus infection in households with low humidity conditions was higher than control households, as well as suggesting that the handwashing could limit the surface contagion. Judah et al[42] pretested interventions (among different genders) to identify their effectiveness in increasing handwashing with soap in a natural settings. The results revealed that observation of behavior could help to recognize the most effective interventions for behaviors changes. Besides, Grayson et al[43] studied the effectiveness of soap and water-based handwashing, and alcohol-based hand sanitizers. The results suggested that there was positively effectiveness in reducing the influenza virus on hands, especially for soap and water-based handwashing. For cases of influenza requiring hospitalization, Godoy et al[44] investigated this effectiveness, the results of the group indicated that regular handwashing was encouraged to prevent the influenza virus in the hospitalization-required cases. Additionally, the handwashing after contacting the

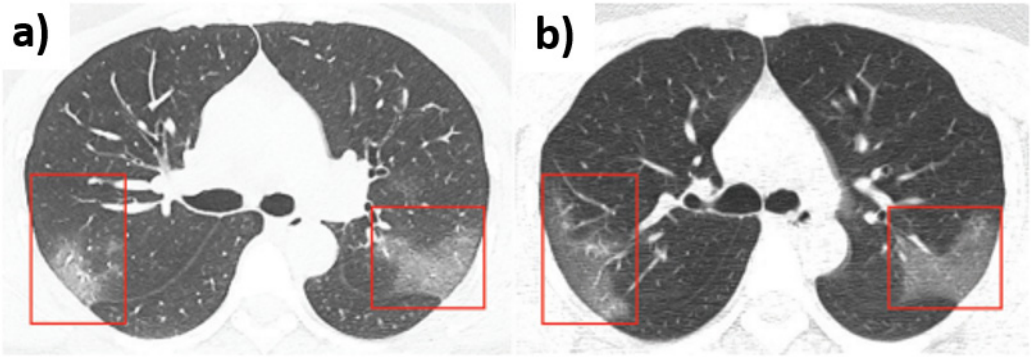

Figure 1. CT images of a 33-year-old woman: (a) Bilateral ground-glass opacity visible in lungs, and (b) Progressive ground-glass opacity in the posterior segment of the right upper lobe, and the apical posterior segment of the left superior lobe, after three days of following-up. Reprinted with permission from Lei et al. [20]

Table 1. Published papers in the effectiveness of handwashing against influenza infection

Methods	Surveyed people	Results	References
Antimicrobial gel-based handwashing	Hospitals (patients)	The number of new infectious patients was reduced (42.0%).	33
Alcohol gel-based hand sanitizers	Hospitals (patients)	The infection rates decreased (36.1%). Also, it provided a tool for an effective infection control program in acute care facilities.	34
Alcohol-based hand disinfection, and handwashing	Hospitals (patients, health care workers)	The program was cost-effective from a societal perspective.	35
Handwashing	Young adults in military training	There was a reduction in outpatient visits for respiratory illness (45.0%). There were challenges in the time-constrained setting of military training.	36
Soap and water-based handwashing	Households (children)	Daily Soap-based handwashing was truly effective in preventing both diarrhea and respiratory disease, and daily bathing-based handwashing also prevented impetigo.	37
Handwashing	Child care center	There was a meaning reduction in respiratory illness in children 24 months of age and younger (17.0%).	38
Alcohol-based hand sanitizers, and handwashing	Students in university residence halls	The upper respiratory illness symptoms were fewer (ranging from 14.8% to 39.9%), both illness rates and absenteeism were lower with an order in 20.0% and 43.0%.	39
Handwashing	Households (different genders, ages)	The influenza virus infection in households with low humidity conditions was higher than control households, as well as it suggests that the handwashing could limit surface contagion.	41
Soap and water-based handwashing	Highway service station restrooms (different genders)	Observation of behaviors could help to recognize the most effective interventions for behaviors changes in a natural settings.	42
Soap and water-based handwashing, and alcohol-based hand sanitizers	Health care workers	A positive effect was observed in reducing the influenza virus on hands, especially for soap and water-based handwashing.	43
Alcohol-based hand sanitizers and Handwashing	Hospitals (patients), and community (different genders, ages, ethnicity, etc.)	In hospitalization required cases, regular handwashing and the handwashing after contacting the contaminated surfaces were identified as effective, and it had a similar effect for the alcohol-based hand sanitizers.	44

contaminated surfaces was also surveyed and determined as effective. The use of alcohol-based hand sanitizers was involved in marginal benefits. Moreover, the handwashing after contacting with potentially contaminated surfaces had a similar effect. However, there are some limitations which have not been clarified in these studies, such as: (*i*) the number of participants and the performed randomization order, (*ii*) The contaminating influenza virus concentration used to mimic a clinical worst case". To assume/suppose for clinical worst case to survey the effectiveness of the handwashing and (*iii*) the alcohol concentrations and the soap types.

Overally, the human-to-human transmission from hand contact is one of the main causes of the COVID-19 outbreak progression. There are also concerns regarding the effectiveness of the handwashing against the COVID-19 pandemic. Water-based handwashing reduced the prevalence of bacteria/virus; however, the soap and water-based handwashing are further effective in reducing the infection prevalence. There was a trend that soap and warm water-based handwashing was also further effective in reducing another prevalence, but the statistical support was low. Thus, the soap and water-based handwashing took only a bit longer than the water-based handwashing. It seems that this little difference could interpret the large difference in the removal of bacteria/virus. In addition to soap's own anti- bacterial and viral effects, its use during handwashing leads to a longer handwashing. Hence, people should use soap and water (or warm water)-based handwashing, or use alcohol-based hand sanitizers. Due to the lack of effective vaccine and drug, these strategies are required to be implemented, especially in low- and middle-revenue countries, since the primary problem to degrade the number of patients with severe disease and deaths from the COVID-19.

Conclusion

In summary, the COVID-19 pandemic is regularly expanding by the time, so people should comprehend clearly the needful knowledge to limit or stop-up this disease outbreak. Besides, in order to protect ourselves and effectively perform instant strategies in COVID-19 prevention, people should diligently wash hands with soap and water (or warm water) or use alcohol-based hand sanitizers, thoroughly cook meat and eggs, cover mouth and nose in speaking, coughing, and sneezing, avoid close contact in crowds to reduce the risk of COVID-19 spread through the community.

Conflict of Interest

The authors declare that they have no competing interests.

Ethical Approval
Not applicable.

Authors' contributions
All authors have contributed to the writing of the manuscript. TSV designed the topic and wrote the manuscript. TTTNV and TTBCV edited the final manuscript. All authors read and approved the final manuscript.

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