

LETTER TO THE EDITOR**Influencing Factors on COVID-19 Infection Despite Protective Measures Among Orthopedic Residents: Air Ventilation and Contact Duration****Dear Editor**

It is almost 3 months since the report of the first case in China and 1.5 months since the report of the first case in Qom, the epicenter of Iran. The very first reports were assuring about its mortality rate, even lower than 0.1% in common influenza, which was then proven otherwise after it started spreading in South Korea, Iran, and Italy with mortality rates of as high as 10% (1). The Ministry of Health in Iran took unprecedented actions and escalated infection control almost 3 weeks after detection of coronavirus spread by suspending all elective surgeries throughout the country and designating specific hospitals for caring COVID-19 patients to separate infected people. Among these, the university-based hospital and the orthopedic department was also shut down and emptied to admit the high volume of patients with COVID-19, and suddenly all floors turned to COVID floors. Considering exponential rise in the number of patients, we, the orthopedic surgeons, became part of the same team and we were also assigned to daily visit the admitted COVID-19 patients in our own ward to reduce the burden on pulmonologists, anesthesiologists, and infectious disease specialists. Moreover, orthopedic residents were urged to take some Emergency Medicine calls to screen the pulmonary patients at the frontline. Although the fear of infection and death in the community caused shortage of protective measures and sanitizers, we were provided with sufficient protection including bunny suit, N-95 (FFP2) facemask, face shield, shoe cover, and latex gloves [Figure 1]. Of note, the suits and protective equipment were sponsored mostly by donations.

The most important single protective measure against coronavirus is considered a facemask, which is highly advised after finding that the airborne spread of the virus is possible (2). Moreover, the viral load is a determining factor in contracting and presenting symptoms. It is suggested for the patients to contain the infected exhale and the healthy providers to filter the inhaling air. So, a regular surgical mask would be sufficient for a patient while a thicker filter such as N-95 (equivalent European standard: FFP2) or N-99 (equivalent European standard:



Figure 1. Personal Protective Equipment (PPE) while caring of COVID-19 patients.

FFP3) respirator is suggested for the providers. A study of Chinese providers that were infected by COVID-19 showed that less protection resulted in bilateral lung involvement while providers with less contact showed unilateral involvement (3). This is intuitive that the virus is not only settling in the throat mucosa but also travels down to the alveoli and seeds in there causing Organized Pneumonia. This emphasizes on the necessity of wearing a facemask to reduce the possibility of infection.

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Table 1. Demographic characteristics of orthopedic residents after starting to care the COVID19 patients

	HCW1	HCW2	HCW3
Sex	Male	Male	Male
Age	29	27	28
Body mass index	28.5	24	25.6
Contact times per day	>20	>20	>20
Contact duration, hour/day	16	16	16
Time length between first encounter to symptom appearance, days	4	10	11
White Blood Cell	8500	9100	4100
Lymphocyte count	20%	37%	40%
C-Reactive Protein	Neg	1.3	N/A
Erythrocyte Sedimentation Rate	5	8	30
Chest X-ray	Normal	Normal	N/A
Symptoms (numbers are showing the order of presentation)			
Cough	1	2	0
Difficulty breathing	0	1	0
Rapid breathing	0	3	0
Fever	2	1	2
Body ache & fatigue	3	1	1
Vomiting	0	2	4
Diarrhea	0	0	4
Anosemia	0	0	3
Treatment	HCQ+tavanex+multivitamins +ringer infusions	Rest	HCQ+Ondansetrone+Ringer infusion+ vitamin supplements

Other factors that increase the possibility of infection are the number of contacts and duration of each contact. The report of Chinese providers showed a mean of 12 times (7-16 times) and cumulative contact time of 2 hours (1.5-2.7 h) was related with contracting the disease in 30 providers with various amounts of protection (3). We still do not know whether a facemask and whole body coverage can completely eliminate the chance of getting the disease. While we were not anticipating any involvement, 3 out of 5 of our first year orthopedic residents showed symptoms of the disease 2-3 weeks after starting their tasks in the COVID-19 floor [Table 1]. Of note, despite all protective measures, the number of contacts and cumulative contact duration in the frontline screening seem to be the influencing factors. Other residents that were only visiting patients in the COVID floor did not become symptomatic which also highlights the role of ventilation. We assumed that the ventilation in the Emergency Screening area was not as efficient as

the COVID floors and ICUs because only the residents visiting patients in the frontline became symptomatic. The bright side of this scenario was that the symptoms were mild with no or minimal pathology on chest X-ray, which deemed unlikely if the protective measures were insufficient as mortalities were high among providers in the beginning of the crises.

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