



COVID-19 exposure and health status of orthopedic residents: A survey study

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Abstract

Considering the increased patient burden and disruptions in the healthcare system, orthopedic residents are affected both psychologically and physically while working both in the management of trauma patients and caring for COVID-19 patients. Our objective was to investigate the virus exposure and health status of orthopedic residents during the pandemic and to review the measures that can be taken. A survey consisting of 15 questions was organized and circulated through e-mail groups and social media platforms in order to evaluate the health status of residents. Demographic data, co-morbidities, whether they had a COVID-19 infection, time they work in orthopedics-related and COVID-related units, whether there was infection among their colleagues or family members and the infected patient care were questioned. A total of 136 residents completed the survey, of which 41 (30.1%) were infected. A significant difference was found between COVID-infected and COVID-free residents in terms of comorbidities ($p=0.026$). Residents with infection among their colleagues had lower infection rates ($p<0.001$). No significant difference was found between groups in terms of the working periods in orthopedics-related or COVID-related units ($p>0.05$ for each). With this study, the infection rate among orthopedic residents were reported for the first time in the literature, considering the fact that a third of all the participants in our study were infected. The infection rate among the orthopaedics residents were reported for the first time in the literature with this study. The fact that residents with infected colleagues have lower infection rates, demonstrates the importance of self-awareness and protective behaviors. During the pandemic, all healthcare professionals should pay maximum attention for simple measures, like practicing protective behaviors and use of personal protective equipment.

Keywords: Covid-19 pandemic, orthopedics and traumatology, protective measures, resident, survey

1. Introduction

March 11, 2020 is the date when COVID-19 was declared as pandemic all over the world and the first case was detected in our country (1). Since that day, extraordinary measures have been taken against COVID-19 in our country, similar to those around the world, such as prohibitions of city entrances and exits, curfews, closure of social areas, turning regular hospitals into pandemic hospitals and continuously educating citizens and increasing perception about the importance of protective behaviors (2-4).

As part of these measures, all healthcare professionals have and continue to fight the COVID-19 infection alongside their primary duties, through regulations and decree laws. Although elective surgeries were stopped during the first and second waves, orthopedic residents continued to manage trauma patients while at the same time caring for COVID-19 patients and were inevitably affected both physically and psychologically during this process (5). Moreover, increasing patient burden and intense work pace also augmented these effects (6, 7).

Our objective was to investigate the virus exposure and health status of orthopedic residents during the pandemic and to review the measures that can be taken in order to

reduce the residents' incidence of COVID-19 infection.

2. Material and Methods

Following the approval of the Scientific Research Platform of the Ministry of Health, a survey consisting of 15 questions was organized by two board-certified specialists of orthopedics and traumatology, in order to evaluate the health status of orthopedic residents (Table 1). According to the data from Turkish Association of Orthopedics and Traumatology (TOTBID), there are over 900 residents currently working in our country and we aimed to reach as many as possible to obtain a nation-wide conclusion. For this purpose, the 15-question survey was circulated in Turkish via the official e-mail group of TOTBID, and also through the social media platforms. In order to encourage the completion of the survey, questions were designed as the total filling time of all survey not to exceed three minutes. Participation in the survey was entirely voluntary, and participants who wished were given the right to leave blank questions they did not want to answer.

The survey was created using Google Forms (Mountain View, California, USA) and consisted of two parts. First part has designed to question the demographic data of the

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participants, such as age (older or younger than 30 years), gender, institution they work (university or training and research hospital), smoking, comorbidities and whether they had a COVID-19 infection or not in the last year. In terms of COVID-19 infection, participants only with a positive polymerase chain reaction (PCR) test were considered as “COVID-infected” whereas participants with compatible clinical or radiological findings with coronavirus infection but had a negative PCR result were considered as “COVID-free”; this classification was used in order to make an objective distinction between groups. The second part of the survey was designed to question the participants’ working periods and virus exposure.

Table 1. A survey consisting of 15 questions

Your age?	
Your gender?	Male/Female
Institution you work?	University Hospital/ Training and Research Hospital
Do you have any chronic diseases?	Yes/No
Do you smoke?	Yes/No
Did you have a PCR+COVID-19 infection in the last year?	Yes/No
How long have you worked in orthopedic emergency rooms during the last year?	Less than 4 days per month 4-8 days per month More than 8 days per month
How long have you worked in orthopedic inpatient services during the last year?	Less than 1 month 1-6 months More than 6 months
How long have you worked in orthopedic clinics during the last year?	Less than 1 month 1-6 months More than 6 months
How long have you worked in orthopedic operating rooms during the last year?	Less than 1 month 1-6 months More than 6 months
How long have you worked in COVID-related units (inpatient services, intensive care units, outpatient clinics, etc.) during the last year?	Less than 2 months 3-4 months 5-6 months More than 6 months
Have any of your colleagues in your clinic had a PCR+COVID-19 infection in the last year?	Yes/No
Have any of your family members who you live with had a PCR+COVID-19 infection in the last year?	Yes/No
Did you have any direct contact with a PCR+COVID-19 infected patient while wearing personal protective equipment?	Yes/No
Did you have any direct contact with a PCR+COVID-19 infected patient without wearing any personal protective equipment?	Yes/No

Participants were asked to specify their working periods in orthopedic emergency rooms, inpatient services, outpatient clinics, operating rooms and also in any COVID-

related units (inpatient services, intensive care units, outpatient clinics). While determining the answer options, considering the working conditions of residents in daily practice, the working period in the orthopedic emergency room was determined as days/per month (less than 4 days, 4-8 days or more than 8 days) while the other periods were determined as months (less than 1 month, 1-6 months, more than 6 months). Participants were also questioned about whether they took part in treating a coronavirus-infected patient with or without personal protective equipment. They were also asked whether there were any infected healthcare professionals among their team or any infected family members staying in their house.

When evaluating the survey results, participants were divided into two groups based on whether they had a PCR-positive COVID infection or not: COVID-infected and COVID-free residents. Difference between groups in terms of demographic data, working periods and virus exposure were analyzed.

Statistical analysis was done with SPSS 26.0 version. Whether there was a difference between the groups in terms of categorical data was compared with the Chi-square Test. When the observed values did not meet the Chi-square assumption, Fisher’s Exact Test was used. The cases where the p value was less than 0.05 were considered significant.

3. Results

A total of 136 residents (approximately 15% of all residents in the country) completed the survey, of which 41 (30.1%) were infected. Among the participants, five residents chose not to fill in one question of the survey: three residents did not fill the “Working Period in COVID-related Units” question, one resident did not fill the “Working Period in Orthopedic Inpatient Services” question and another resident did not fill the “Working Period in Orthopedic Outpatient Clinics” question.

A significant difference was found between COVID-infected and COVID-free residents in terms of comorbidities ($p=0.026$). Detailed demographic data of the participants were shown in Table 2.

Residents with infected colleagues had lower infection rates ($p<0.001$). Detailed virus exposure of the residents can be seen in Table 3.

There was no significant difference between COVID-infected and COVID-free residents in terms of the working periods in orthopedics-related or COVID-related units ($p>0.05$ for each) (Table 4).

4. Discussion

Considering the high rate of infectiousness, lack of therapeutic treatment, continuing vaccine discussions and studies, and the prevalence of variants of the virus, the global pandemic of COVID-19 has affected all aspects of healthcare system (4). Residents have had their share of this

effect. There are several studies investigating the mental stress and educational defects of residents and other healthcare professionals from all branches in the literature, alas, studies evaluating the physical health status of them are quite limited (8-12).

Moreover, orthopedic residents were more worn out compared to other branches in this process, due to their active role in the care of both trauma patients and COVID-19 patients, although elective surgeries were suspended from time to time. To our knowledge, this study was the first to investigate the physical health status of orthopedic residents and this is the main strength of our study. Most important finding of our study was that approximately one third of

orthopedic residents are infected during the pandemic in our country, with no significant difference between infection rates and working periods in orthopedics-related and COVID-related units. Furthermore, orthopedic residents who have COVID-infected colleagues in their team had lower infection rates.

Awareness, increased perception against COVID-19 and regular practice of protective behaviors such as washing hands regularly, covering mouth and nose when coughing, wearing masks and social distancing are known as the only effective ways in preventing the exposure of COVID-19 (13). Moreover, use of protective personal equipment is essential for healthcare workers (14).

Table 2. Demographic profile of the participants

Variables		Orthopedic Residents		P
		COVID-infected (n= 41)	COVID-free (n=95)	
Age	Under 30 years	25 (61%)	61 (64.2%)	0.720
	30 years and above	16 (39%)	34 (35.8%)	
Gender	Female	1 (2.4%)	1 (1.1%)	0.514
	Male	40 (97.6%)	94 (98.9%)	
Institution	Training and Research Hospitals	24 (58.5%)	67 (70.5%)	0.173
	University Hospitals	17 (41.5%)	28 (29.5%)	
Comorbidity	Yes	5 (12.2%)	2 (2.1%)	0.026
	None	36 (87.8%)	93 (97.9%)	
0.026	Yes	13 (31.7%)	43 (45.3%)	0.140
	None	28 (68.3%)	52 (54.7%)	

n: number of samples; P: statistical significance value

Table 3. History of infection among team members, family members and patients

Variables		Orthopedic Residents		P
		COVID-infected (n= 41)	COVID-free (n=95)	
Infection among Team Members	Yes	28 (68.3%)	92 (96.8%)	<0.001
	No	13 (31.7%)	3 (3.2%)	
Infection among Family Members	Yes	15 (36.6%)	22 (23.2%)	0.106
	No	26 (63.4%)	73 (76.8%)	
Contact with an Infected Patient with PPE*	Yes	35 (85.4%)	89 (93.7%)	0.184
	No	6 (14.6%)	6 (6.3%)	
Contact with an Infected Patient without PPE*	Yes	28 (68.3%)	74 (77.9%)	0.235
	No	13 (31.7%)	21 (22.1%)	

*PPE: Personal Protective Equipment; n: number of samples; P: statistical significance value

Table 4. Working periods of residents in orthopedics-related and COVID-related units

Variables		Orthopedic Residents		P
		COVID-infected (n= 41)	COVID-free (n=95)	
Working Period in Emergency Rooms (Per month)	0-4 days	10 (24.4%)	25 (26.3%)	0.956
	4-8 days	14 (34.1%)	33 (34.7%)	
	>8 days	17 (41.5%)	37 (38.9%)	
Working Period in Orthopedic Inpatient Services*	<1 month	11 (26.8%)	26 (27.7%)	0.955
	1 – 6 months	11 (26.8%)	27 (28.7%)	
	> 6 months	19 (46.3%)	41 (43.6%)	
Working Period in Orthopedic Outpatient Clinics*	<1 month	16 (39%)	29 (30.9%)	0.563
	1 – 6 months	12 (29.3%)	27 (28.7%)	
	> 6 months	13 (31.7%)	38 (40.4%)	
Working Period in Orthopedic Operating Rooms	<1 month	7 (17.1%)	14 (14.7%)	0.891
	1 – 6 months	15 (36.6%)	33 (34.7%)	
	> 6 months	19 (46.3%)	48 (50.5%)	
Working Period in COVID-related Units*	0 – 2 months	19 (46.3%)	40 (43.5%)	0.056
	3 – 4 months	18 (43.9%)	25 (27.2%)	
	5 – 6 months	3 (7.3%)	14 (15.2%)	
	> 6 months	1 (2.4%)	13 (14.1%)	

*Not all the participants have completed the survey. n: number of samples; P: statistical significance value.

Hirschmann et al. have stated the importance of using personal protective equipment and raising awareness for orthopedic surgeons (15). Our results are consistent with the literature. Although, nearly one third of all participants got infected during the pandemic, the fact that residents who have COVID-positive colleagues in their team had lower infection rates shows the importance of conscious and awareness in preventing contamination. Furthermore, the lack of difference in infection rates between orthopedic residents who treat COVID-infected patients with or without personal protective equipment supports our hypothesis that practicing protective behaviors and increasing awareness is crucial to prevent getting infected.

The fact that orthopedic residents working in training and research hospitals have significantly higher working periods in COVID-related units compared to residents working in university hospitals ($p=0.002$) can easily be explained by the administered regulations and decree laws, considering the transformation of large-scale training and research hospitals into pandemic hospitals. On the other hand, the similarity of infection rates among residents working in university or training and research hospitals and among orthopedics-related or COVID-related units indicates that, regardless of the institution and unit they work, orthopedic residents act consciously and well-informed against the pandemic and always pays attention to preventive behaviors and use of personal protective equipment, if necessary. During busy working hours, regardless of their duties of emergency nursing care or COVID-19 patient care, all residents must take care of themselves and pay attention to preventive measures.

A meta-analysis has stated that chronic respiratory diseases, diabetes, hypertension and cardiovascular disease are risk factors for COVID-19 infections (16). Abdulla et al. have found a correlation between the severity of COVID-19 and asthma and smoking (17). Algahtani et al. have stated that smoking and its underlying respiratory pathologies are known to be risk factors for severe COVID-19 infection (18). In our survey, 56 (41.2%) participants were smokers and 7 (5.1%) participants had chronic diseases; 4 (2.9%) participants had asthma whereas 3 (2.2%) participants had cardiovascular diseases. We have found a significant relationship between the presence of comorbidities and the occurrence of infection ($p=0.026$), similarly to the literature. On the other hand, the lack of a relationship between smoking and the infection rates in our study ($p=0.140$) can be explained by the relatively small sample size. Furthermore, there are many confounding factors related with infection rates, such as co-existing comorbidities, state of immune system, body resistance and having an active daily life.

There are many studies investigating the relationship between COVID-19 infection and age and gender. In their study of 8541 COVID-19 patients, Takeuchi et al. concluded

that the incidence of the disease did not differ between genders (19). However, Martin et al. have stated that rate of infection is higher in women whereas complication rates and severity are higher in men (20). Many studies examining the relationship between age and COVID-19 infection have found a significant relationship between older age and severity and mortality of the disease (21, 22). However, most of these studies set the age of 60 as the limit. In our survey, with an age limit of 30 years, no significant difference was found between groups in terms of age and gender. Considering that the majority of orthopedic residents are male and younger adults, it was expected to find no relationship between the age and gender of the participants and the prevalence of the disease.

There are several limitations in our study. First and foremost, although our findings suggest a nation-wide idea about the health status and virus exposure of orthopedic residents across the country, a participation rate of 15% is an important limitation. Different results can be obtained with larger surveys, where the participation of more residents is encouraged. Moreover, by including other surgical and internal branches, better results can be obtained. Finally, the participants were divided into only two groups, as COVID-infected and COVID-free, according to the PCR results. Although this classification, as mentioned before, was chosen in order to make an objective distinction, the accuracy of the PCR test may affect the results of our study.

We have reached the conclusion that a third of all the participants in our study were infected with COVID-19, regardless of the clinics they work in. The infection rate among the orthopaedics residents were reported for the first time in the literature with this study. Residents with infected healthcare professionals in their team have lower infection rates, indicating the importance of self-awareness and protective behaviors. During the pandemic, all healthcare professionals should pay maximum attention for simple measures, like practicing protective behaviors and use of personal protective equipment.

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Conflicts of interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

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