

Epidemiology of Corona Virus Infection (COVID 19) among Health Care Workers in Benha University Hospital, Egypt

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Abstract

Background: COVID-19 has become an important public health issue in the world. Health care workers (HCWs) are at high risk of infection contributing to further spread. **Objectives:** to describe the clinical manifestations, treatment lines of COVID-19 among HCWs and to compare infection control measures between cases and controls. **Method:** This case control study was conducted upon 184 confirmed infected HCWs with COVID-19 and equal number of healthy controls in Benha university hospitals, from April 6 to October 15, 2020. Data were collected by a structured questionnaire together with laboratory results and treatment received. Infection prevention and controls measures were compared between cases and control HCWs. **Results:** Among 184 patients, 27.8% of cases had pneumonia. The most common symptoms were bone pain (86.4%). There were significant differences between cases and controls regarding following hand hygiene practice, knowing five moments of hand hygiene and using personal protective equipment (PPE). **Conclusions:** The majority of COVID-19 cases are mild. Lack of use of PPE and lack of hand hygiene practice were among risk factors of infection.

Keywords: COVID-19; HCWs; PCR; clinical characteristics; risk factors.

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Introduction

In early December 2019, the first pneumonia cases of unknown origin were identified in Wuhan. It has been currently named severe acute respiratory syndrome coronavirus (SARS-CoV-2), which causes COVID-19.¹ WHO announced COVID-19 outbreak a pandemic on March 11, 2020.² As of July 22, 2020, more than 15 million cases of COVID-19 have been documented worldwide, with about 618 000 deaths.³ There is human-to-human transmission through large droplets, contact and by touching surfaces contaminated by them and then touching the mouth, nose and eyes.⁴ The incubation period is from 2 to 14 days [median 5 days]. The common

clinical presentations of covid-19 include fever, cough, headache, sore throat, fatigue, myalgia and breathlessness⁵, also there are smell/taste disorders.⁶

Laboratory-confirmed SARS-CoV-2 infection needs the detection of nucleic acid of the virus in respiratory samples through real-time reverse-transcription-polymerase-chain-reaction (RT-PCR).⁷ The estimated median duration to negative RT-PCR tests of upper respiratory samples was 11days.⁸ There may be increased CRP, lymphopenia, D-dimer might be elevated and hyperferritinemia in severe disease.⁹ Chest CT reveals ground glass opacities,

infiltrates, and subsegmental consolidation.¹⁰

Till date, no confirmed treatment is available and so the treatment is supportive and symptomatic. The first step is adequate isolation to prevent transmission to others.⁵

Chloroquine may be effective in the early stage of infection¹¹, but no positive feedbacks were noticed after taking antiviral treatment with oseltamivir.¹²

Zithromycin has been used as adjunctive treatment to get antibacterial coverage, immunomodulatory and anti-inflammatory effects in the management of some viral respiratory tract infections.¹³

Patients taking anticoagulants had a decreased mortality as COVID-19 lead to disseminated intravascular coagulation.¹⁴

HCWs are essential workers and have the risk for exposure to patients or infectious materials. Also, HCWs might potentially have a role in hospital transmission. The extent of COVID-19 transmission and risk factors associated with infection in health-care settings are unclear. Without enough protection, COVID-19 morbidity and mortality may be elevated among healthcare workers and their family.

Several studies have demonstrated the risk factors leading to COVID-19 acquisition by HCWs in healthcare settings. A leakage of PPE, long-time exposure to infected patients and inadequate training in infection prevention and control have been the most prominent causes. A survey study about the number of HCWs have been infected with or died from COVID-19 was done across 37 countries including Egypt from 22 July to 15 August 2020, a total of 750 infections and 56 deaths were reported in Egypt.^{15, 16, 17, 18}

The objectives are to: 1) describe clinical symptoms, lines of treatment of COVID-19 among HCWs in Benha university hospitals; and compare between cases with pneumonia versus no pneumonia 2) describe the effects of COVID-19

infections on blood levels of some mediators (as D-dimer, ferritin, C-reactive protein); and 3) compare infection control measures between cases and control.

Method

Study design and participants: this case control study that was conducted upon 184 confirmed infected HCWs with COVID-19 in Benha university hospitals, from April 6 (the first confirmed case of COVID-19) to October 15, 2020 (the last collected cases) by convenient sampling and an equal number of HCWs controls were selected by systematic random sample from the same hospital. The patients were assessed for symptoms, treatments received and duration until becoming negative by RT PCR.

A confirmed case was defined as a suspected case with the laboratory test for the COVID-19 from the respiratory specimens show positive result by RT-PCR assay. Asymptomatic case was defined as a confirmed case with normal body temperature or minor dis-comfort; symptomatic non pneumonia case was defined as a confirmed case with fever and/or respiratory symptoms, but no radiographic evidence of pneumonia while symptomatic pneumonia case was defined as a confirmed case with fever, respiratory symptoms and radiographic evidence of pneumonia.¹⁹

Data collection: the following data for cases were abstracted from patient's file. Both cases and control were phone interview to complete missed data. 1- personal data (age, sex, residence, occupation, smoking and other comorbidities) 2- clinical presentation of COVID-19 infection (severity of cases either having or not having pneumonia depending on clinical diagnosis and chest imaging, fever, duration of fever, cough, duration of cough, loss of smell, bone pain, fatigue, headache, rhinorrhea, dyspnea, vomiting, diarrhea and

Table (1): Socio –demographic characteristics and comorbidity of COVID-19 cases

Socio-demographic and clinical characteristics		Total no= 184	
		No	%
Sex	Male	105	57.1
	Female	79	42.9
Age (years)	Mean ±SD (Range)		
	27.21±4.9 (20-45)		
Residence	Urban	85	46.2
	Rural	99	53.8
Occupation	Doctor	106	57.6
	Nurse	78	42.4
Cigarette smoking		15	8.2
Comorbidities	Chronic lung diseases	22	12.0
	Cancer	1	0.5

throat congestion), site of isolation. 3- Results of laboratory investigations (C reactive protein, ferritin, D dimer, hemoglobin, lymphocytes, white blood cells, platelets), blood group and chest CT. 4-Treatment received (antibiotics, vitamins, oral anticoagulants, Tamiflu and chloroquine). 5- Infection prevention and controls factors (take infection control practices in hospital, follow hand hygiene practice, know five moments of hand hygiene {1: before touching a patient, 2: before clean/aseptic procedure, 3: after body fluid exposure risk, 4: after touching a patient, 5: after touching the patient surroundings}, availability of PPE, use PPE and availability of soap and water).^{19, 20, 21, 22, 23, 24, 25}

Statistical analysis: The collected data were tabulated and analyzed using the Statistical Package for Social Science, version 16.0 for windows, (SPSS Inc, Chicago,IL). Categorical data were summarized as frequency and proportion. Chi-square test and Fishers exact test were used as tests of significance. A P-value ≤ 0.05 was considered statistically significant.

Ethical consideration: An informed written consent was obtained from the participants,

it included data about objectives, methods, benefits, expected harms and confidentiality of data. An approval from the Research Ethics Committee in Benha Faculty of Medicine was obtained to conduct this work (RC 3-4-2021).

Results

This study included 184 confirmed infected HCWs with COVID-19 their age ranged between 20 and 45 years. The males constituted 57.1% of the studied group, 53.8% of cases were from rural areas, 57.6% of the infected cases were doctors, 8.2% were cigarette smokers and 12.0% of the cases have chronic lung disease (Table 1).

There was statistically significant difference between cases and controls regarding following hand hygiene practice, knowing five moments of hand hygiene and using personal protective equipment ($P \leq 0.05$) (Table 2).

More than one-fourth (27.8%) of cases were suffering from pneumonia. 80.4% of COVID-19 cases had fever, of them 39.2% had body temperature >39 C and ranged between 1 and 14 days. This study demonstrated that 77.2% of COVID-19 cases had cough that ranged between 1 and 30 days. Infected HCWs were suffering from loss of smell (49.5%), bone pain (86.4%), fatigue (64.7%), headache (53.8%), dyspnea (17.4%), rhinorrhea (9.2%), diarrhea (66.8%), vomiting (21.2%) and throat congestion (31.5%). The duration of symptoms ranged between 2 and 30 days. There were 84.8% of cases had history of contact to cases with COVID-19 and duration between contact and occurrence of illness ranged between 2 and 7 days. The number of days to convert negative ranged between 7 and 35 days. There was statistically significant difference between symptomatic cases without pneumonia and symptomatic cases with pneumonia regarding fever, loss of

Table (2): Comparison between cases and control regarding infection control practices

Infection control practices	Cases (n=184)		Controls (n=184)		Test χ^2	P	
	No	%	No	%			
Taking infection control practices in hospital	93	49.7	94	50.3	0.011	0.91	
Follow hand hygiene practice	110	42.3	150	57.7	20.96	<0.001	
know five moments of hand hygiene	1 moment	10	66.7	5	33.3	25.97	<0.001
	2 moments	56	70.0	24	30.0		
	3 moments	42	55.3	34	44.7		
	4 moments	40	40.8	58	59.2		
	5 moments	36	36.4	63	63.6		
Use personal protective equipment	Always	93	43.5	121	56.5	8.75	0.003
	Sometimes	91	59.1	63	40.9		
Availability of personal protective equipment	127	48.3	136	51.7	1.07	0.299	
Availability of soap and water	125	47.9	136	52.1	1.59	0.207	

Table (3): Comparison between cases with pneumonia and cases without pneumonia regarding clinical manifestations of COVID-19

Severity of cases	Symptomatic cases without pneumonia		Symptomatic cases with pneumonia		Test χ^2	P
	No	%	No	%		
Fever	98	73.1	50	100.0	FET*	<0.001
Cough	99	73.9	43	86.0	3.036	0.081
Loss of smell	49	36.6	42	84.0	32.774	<0.001
Bone pain	118	88.1	41	82.0	1.139	0.286
Fatigue	87	64.9	32	64.0	0.014	0.907
Headache	67	50.0	32	64.0	2.871	0.091
Dyspnea	17	12.7	15	30.0	7.597	0.006
Rhinorrhea	9	6.7	8	16.0	3.742	0.053
Diarrhea	82	61.2	41	82.0	7.113	0.008
Vomiting	32	23.9	7	14.0	2.128	0.145
Throat congestion	50	37.3	8	16.0	7.663	0.006

*Fisher Exact test

smell, dyspnea, diarrhea and throat congestion ($P \leq 0.05$) (Table 3).

The laboratory findings of COVID-19 cases were: 32.6% had increased CRP, 15.2% had increased ferritin, 4.9% had increased D dimer, 87.0% had normal hemoglobin, 18.5% had decreased WBCs, 31.5% had decreased lymphocytes and 9.2% had increased level of platelets. There was statistically significant difference between symptomatic cases without pneumonia and symptomatic cases with pneumonia regarding hemoglobin, WBCs, platelets and blood group ($P \leq 0.05$) (Table 4).

The treatment received were 83.2%, 92.4%, 54.3%, 44.6% and 38.6% antibiotic, vitamins, chloroquine, Tamiflu and received oral anticoagulants: respectively. (Table 5).

Discussion

Health care workers are at increased risk of being exposed to viruses within hospitals but can also be a source of transmission by introducing a virus into their hospital. In the current study, a total of 184 confirmed infected HCWs with COVID 19 during April 6 to October 15, 2020 was reported.

Table (4): Comparison between cases with pneumonia and cases without pneumonia according to laboratory findings

Severity of cases		Symptomatic cases without pneumonia		Symptomatic cases with pneumonia		Test χ^2	P
		No	%	No	%		
C reactive protein	Normal	9	6.7	9	18.0	5.880	0.053
	Increased	43	32.1	17	34.0		
	Not done	82	61.2	24	48.0		
Ferritin	Increased	19	14.2	9	18.0	0.412	0.521
	Not done	115	85.8	41	82.0		
D dimer	Increased	9	6.7	0	0.0	FET*	0.116
	Not done	125	93.3	50	100.0		
Hemoglobin	Normal	110	82.1	50	100.0	FET*	<0.001
	Increased	24	17.9	0	0.0		
White blood cells	Normal	85	63.4	41	82.0	11.888*	0.006
	Increased	17	12.7	0	0.0		
	Decreased	25	18.7	9	18.0		
	Not done	7	5.2	0	0.0		
Lymphocytes	Normal	60	44.8	24	48.0	2.866	0.413
	Increased	26	19.4	9	18.0		
	Decreased	41	30.6	17	34.0		
	Not done	7	5.2	0	0.0		
Platelets	Normal	117	87.3	50	100.0	FET*	0.007
	Increased	17	12.7	0	0.0		
Blood groups	A	42	31.3	24	48.0	34.417*	<0.001
	B	25	18.7	22	44.0		
	AB	33	24.6	4	8.0		
	O	34	25.4	0	0.0		

*Fisher Exact test

In a study conducted between June 1st and 14th, 2020, at the gastroenterological service of Al-Manial University Hospital, 74 HCWs were tested using RT-PCR. Of the 74 HCWs, 10 tested positive by RT-PCR (13.5%).²⁶

Previous studies reported variable number of infections among HCWs in developed countries. In a study conducted on 1353 HCWs in Dutch, found that 86 (6%) tested positive for SARS-CoV-2 via nasal swab.²⁷ Higher rates of infection of HCWs were observed in studies from the United Kingdom and Spain in March 2020, where 282/1533 symptomatic HCWs (18%) and 791/2085 (38%) were confirmed to be

infected by SARS-CoV-2 infection via RT-PCR, respectively.^{28, 29}

In this work only 12.5% of cases have comorbidities, most of the cases were mild as evidenced by relatively low rates of cases with pneumonia (27.8), fever was reported in 80.4% of cases, while 77.2% of cases had cough, 64.7% of cases had fatigue. Leukopenia and lymphopenia were noticed in 18.5% and 31.5% respectively. C-reactive protein was increased in 32.6% of cases. The median duration to convert negative was 21 days by (RT-PCR).

These results are quite different than reported in a retrospective study conducted in Shanghai from Jan 20 to Feb 6, 2020, the study enrolled 249 patients of confirmed

Table (5): Comparison between cases with pneumonia and cases without pneumonia regarding treatment

Severity of cases		Symptomatic cases without pneumonia (134)		Symptomatic cases with pneumonia (50)		Test χ^2	P
		No	%	No	%		
Site of isolation	Hospital	73	54.5	32	64.0	41.261	<0.001
	Home	52	38.8	0	0.0		
	Combined	9	6.7	18	36.0		
Antibiotics		118	88.1	35	70.0	8.477	0.004
Vitamins		127	94.8	43	86.0	FET*	0.061
Chloroquine		68	50.7	32	64.0	2.578	0.108
Tamiflu		57	42.5	25	50.0	0.821	0.365
Oral anticoagulants		54	40.3	17	34.0	0.61	0.435

*Fisher Exact test

COVID-19. It showed that 36.1% of cases had one or more coexisting chronic medical conditions. The most common symptoms in COVID-19 patients were fever 87.1%, cough 36.5% and fatigue 15.7%. Leukopenia and lymphopenia were observed in 28.9% and 47.4% of the patients, respectively. C-reactive protein (CRP) was elevated in more than half of the patients. Radiological lesions were observed in 65.7% of patients. The median duration to negative by RT-PCR tests of upper respiratory tract samples was 11 days⁸, however, in retrospective, multicentre cohort study conducted on 191 patients from Jinyintan Hospital and Wuhan Pulmonary Hospital (Wuhan, China), found that the median duration of viral shedding was 20 days in survivors. The longest observed duration of viral shedding in survivors was 37 days.³⁰

In addition, during February 12 April 9, 2020, a total of 9,282 United states health care providers (HCPs) with confirmed COVID-19 had been reported. The median age of HCP patients was 42 years, 73% were female which exceeded that stated in this study mean age was 27.2 years, 42.9% were female. About 1,423 (15%) HCP patients who reported contact with a laboratory-confirmed COVID-19 patient less than reported in this study, 84.4%

reported contact to COVID-19 patients. Two thirds (66%) reported muscle aches less than stated here 86.4%. However, 65% reported headache higher than reported in that study 53.8%, 90% of cases were not hospitalized higher than reported in this study 57.1% only hospitalized.¹⁶

A search was run in the PubMed and Web of Science electronic databases for articles on COVID-19 between February 24, 2020, March 1, 2020, only 5 retrospective clinical studies had met the inclusion criteria. A total of 1556 hospitalized patients with COVID-19, rhinorrhea was rare (4%) that near to finding of this study 9.2% had rhinorrhea.²²

The results demonstrated that 49.5% of infected HCWs had loss of smell. According to recent studies in various countries, the smell and taste is common clinical finding in confirmed cases of COVID-19 disease with a range of frequency from 19.4% to 88% of individuals.³¹

In this study there was statistically significant difference between severity of infection and blood group as 48% of symptomatic cases with pneumonia were of blood group A and most of cases of COVID-19 were in blood group A. This result is similar to study conducted in Wuhan on 1775 with COVID-19, the results

showed that blood group A was associated with a higher risk for acquiring COVID-19 compared with non-A blood groups, whereas blood group O was associated with a lower risk for the infection compared with non-O blood groups.³²

In the current study 44.6% and 83.2% of cases received antiviral drugs and antibiotics therapy respectively. That were incompatible with case series of 99 hospitalized patients with COVID-19 infection from Wuhan, antiviral therapy was given to 75% of the patients.⁵ Also, in study conducted in China between December 11, 2019 and January 29, 2020 that enrolled 1099 patients and the data were obtained from medical record. The study showed that (58%) of cases received antibiotics.³³

This study revealed that there was significant difference between cases and controls regarding use of personal protective equipment. As covering more of the body could provide better protection for HCWs.³⁴ Also, there was significant difference regarding following hand hygiene practice. This is supported by CDC guidelines for the public and health professionals to regularly wash their hands with ordinary soap and water for at least 20 seconds as it is considered the first-line preventive strategy of COVID-19 contamination.³⁵

In this study, there was no significant difference between case and control regarding PPE availability this result is different than reported in a cross-sectional study in Ethiopia the study included 1228 HCWs that reported an overall shortage of PPE the majority (77%) of HCWs reported that their hospital did not have adequate PPE.³⁶

In survey study that was conducted in 33 hospitals in Sudan among workers in all radiology department reported that 75% of all workers had sufficient knowledge about hand hygiene and hand hygiene is

embedded in their routine clinical practice.³⁷ Also, in a cross-sectional study in 13 regions of Saudi Arabia among HCWs in radiology department reported that the majority of radiographic technologists reported wearing the recommended PPE regardless the patient infectious states during this pandemic and 80% of participant received frequent training about infection prevention and control at their health institutions while in this study only 50.8% of participant received training about infection prevention and control practice.³⁸ The study main limitations were not all HCWs had done investigations thus the characteristics of COVID-19 infection were not properly demonstrated. Among HCW patients who reported contact with a confirmed COVID-19 patient in a health care setting, the type of this contact, including whether it was with a patient, other HCW, or visitor was not demonstrated.

Conclusion

The results of this study reflected the frequency of different symptoms, investigations, and treatment lines of COVID-19 infection among HCWs in Benha university hospitals where bone pain and fever were the main symptoms. Antibiotic and vitamins were the main lines of treatment. The severity of COVID-19 infection was statistically significant related to site of isolation, antibiotics intake and blood group. Lack of use of PPEs and lack of hand hygiene practices were among risk factors of infection among cases. Lack of knowledge and practice of infection prevention and control among HCWs could increase the spread of COVID-19 and so there is need to strengthen infection prevention and control practice among HCWs.

Recommendations

Every effort is needed to ensure safety and health of health care worker both at health care settings and the community. Surveillance is essential for monitoring the effect of COVID-19 infection and better implementation of infection prevention and control practices.

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