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Original article

Epidemiological Characteristics of Novel Covid-19 Waves among Patients Registered in Benha University Hospital, 2020-2021

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Abstract

Background: COVID-19 is a global pandemic spread all over the world with 315, 345, 967confirmed cases and causing over 5,510,174 deaths till the mid of Jan 2022. Objective: This is to assess differences between the first and second waves and to determine risk factors of susceptibility and severity of COVID-19 infection. Methods: a retrospective study was conducted on 206 patients with COVID-19, confirmed with RT-PCR in Benha University Hospital. Medical records were reviewed for socio-demographic characters, co-morbidities, and investigations while data about preventive measures and healthy behavior, complications, recurrence, and vaccination status were completed by contacting patients by telephone. Results: Patients not committed to regular hand washing had 2.72 times risk higher than those who committed to regular hand washing to be isolated in hospital (OR=2.72 CI; 1.44-5.13; p<0.01), while patients not committed to the regular wearing of the mask had 1.91 times risk higher to be isolated in hospital than those who committed to it (37.3% vs. 23.7%) respectively (OR=1.91, CI; 1.02-3.60; p<0.05). Co-morbidities such as Cardiac diseases, hypertension, and diabetes mellitus were significantly associated with increased severity of COVID-19 infection. There was a strong positive correlation between the length of hospital stay and the duration of cigarette smoking (p<0.01). Conclusions: smoking, presence of co-morbidities, and decreased commitment to preventive measures were significant risk factors of increased susceptibility and severity of COVID-19 infection.

Key-Words: Benha- COVID-19 – epidemiology - risk factors.

Introduction

World health Organization (WHO) had defined COVID-19 as a global pandemic on March 11, 2020 **(1).**Africa confirmed its first case in Egypt on Feb14; 2020 **(2),** while the second wave began in Egypt on November 26; 2020 till the end of March 2021**(3).**

Many safety instructions were declared to reduce risk of COVID-19 transmission. As washing hands regularly and thoroughly with soap and water for at least 20 seconds or with at least 60% alcohol based hand rub sanitizer**(4)**, covering mouth and nose with a flexed elbow or tissue when coughing and sneezing (cough etiquette)**(5),** maintain social distancing (maintain at least 1 meter or 3 feet distance between yourself and anyone) and avoid close contact with people who were sick, avoid touching eyes, nose and mouth**(6)** and stay home and isolate yourself from others if you feel sick**(7)**

The corona virus infection-2019 (COVID-19) became clinically manifested in a broad range from mild symptoms to life-threatening multi-organ failure (MOF) **(8).**

Assessment of severity of COVID-19 patient confirmed with RT- PCR is simplified as mild, moderate, sever and critically ill cases. Mild case was usually presented with symptoms of common cold. While moderate case usually showed pneumonia without hypoxia. Severe cases were presented with pneumonia with hypoxia responding to oxygen therapy. While critically ill case was presented with pneumonia with hypoxia but not responding to oxygen therapy and /or organ dysfunction **(9, 10)**.

Hospitalization risk was doubled for people with type-2 diabetes or obesity, increased by two-thirds for people with heart disease, and by 75% for each decade of age over age 40. Severe and critical cases were admitted to intermediate and intensive care units respectively **(11)**.

Objective:

Is to assess differences between the first and second waves and to determine risk factors of susceptibility and severity of COVID-19 infection.

Subjects and Methods:

1. Study design: Retrospective study

2. Study setting: Participants were recruited from Benha University Hospital (Benha University Hospital was one of the four COVID-19 isolation hospitals in Benha city.

3. Study period: Collection of data was from May 2020 till end of May 2021. Socio demographic data and results of investigations were collected from medical records of patients reviewed or isolated in Benha University Hospital during the 1st and 2nd COVID-19 waves. The first wave in Egypt began on Feb14; 2020 while the second wave began on November 26; 2020 till the end of March 2021 **(3).**

Detailed data about co-morbidities, place of isolation, preventive measures and healthy behaviour and vaccination status using a questionnaire was obtained by telephone call with the patients or their relatives daily after 4 PM.

5. Study subjects: Participants were identified using a centrally complied list of all patients at Benha University Hospital following positive COVID-19 test and fulfilling the inclusion criteria.

Inclusion criteria:

- All participants must be diagnosed as confirmed COVID-19 patients by PCR test of nasopharyngeal swabs.
- Adult patients (>18 years old).

Exclusion criteria:

- No contact details were available for the patient.
- Less than 18 years of age (age of childhood).
- Death after discharge.

6. Sampling Design

a- Sample technique:

Four hospitals in Benha city were selected as an isolation hospital for COVID-19 confirmed cases. These hospitals were Benha Fever Hospital, Benha University Hospital, Health insurance hospital and Benha Teaching Hospital. Benha University Hospital was selected for convenience. A list of all diagnosed COVD-19 patients in Benha University Hospital during the study period was prepared and classified into hospital and home isolated patients. Home and hospital isolated patients were chosen by systematic random sampling technique

then enrolled by every 2nd in the list, the first one was chosen randomly.

b- Sample size:

Patients were chosen by systematic random sampling technique and were recruited in the study until fulfilled minimal sample size.

Sample size calculation:

Sample size was calculated using Cochran's Sample Size Formula **(12).**

$$SS = Z^2 \times (P) \times (1-P) / E^2$$

Z= Z value (e.g. 1.96 for 95% confidence level).

P = percentage picking a choice, expressed as decimal (0.16% used for sample size needed).

Number of cases in Egypt/ total number of population in Egypt =166,492 / 101,264,000=0.16 % **(13).**

E = Standard error, expressed as decimal (e.g., .05).

According to **MOHP, 2021(13)** the incidence of COVID-19 in Egypt was 0.16 %, so the minimal calculated sample size according to the mentioned formula was 206 patients.

7. Study methods and tools

Data were obtained from hospital records after taking patient`s permission. Patients were followed up via telephone to obtain data regarding complications, recurrence of symptoms and vaccination after obtaining informed oral consent.

Socio-demographic data was obtained like name, age, sex, occupation, residence and duration of work in medical field.

B) Modified COVID-19 case questionnaire: for

COVID-19 case questionnaire developed by **New South Wales (NSW) (14) in 2021** used for assessment of COVID-19 manifestations among COVID-19 patients during the 1st and 2nd waves.

It includes question about:

i. **Isolation data:** Home or hospital(Ward /ICU) and length of hospital stay
ii. **Co-morbidities as** cardiac diseases, chronic lung disease, diabetes, liver disease, immunosuppression diseases, cancer and others.
iii. **Preventive measures & healthy behaviors as** regular hand washing, regular wearing a mask (type of mask and duration of mask exchange), social distance / meters, cough etiquette, regular objects disinfection.

iv. **Vaccination status:** type, dose, side effect of the vaccine and causes of not administering the vaccine.

II - Administrative and Ethical design:

- An official permission was obtained from the Dean of Benha Faculty of Medicine and the administrators of Benha University Hospitals to conduct this study.

Ethical consideration:

- An approval from Research Ethics Committee (REC) in Benha faculty of medicine was obtained.
- An informed oral consent was obtained from the patients before participation, the researcher told the patient about aim of the work, confidentiality of the patient's data and the patient's right to receive medical advice even if he/she refused to participate.

IV- Data management and statistical analysis:-

The collected data was coded, entered, analyzed then presented by suitable tables and graphs using Statistical Package for the Social Sciences (SPSS) 20.0 for windows ***(SPSS Inc., Chicago, IL, USA)***. The normality of distribution for the analyzed variables was tested using Kolmogorov-Smirnov test. The collected data were summarized in terms of Median **(IQR)** for quantitative data. A comparison between categorical data was carried out using the chi-square (**$\chi 2$**) and Fisher's Exact test (**FET**). Correlation analysis was done to determine the association between severity of COVID-19 and other variables. The accepted level of significance in this work was ($p \leq 0.05$), $p \leq 0.01$ was considered highly statistically significant (HS).

Results

This study shows that the median age and the Inter Quartile Range (IQR) of the studied group was 38 years (29-56). Females represented two thirds of the study group and rural residents represented 68% of the study group. Nearly half of the studied group was medical workers (51.0%); the median duration of work in medical field was 9 years. Regarding smoking, majority of participants (86.4%) were non-smokers, while smokers represented (11.7%) and 1.9% were x-smokers, cigarette smoking was the predominant type of smoking (٨٣.4%). About half of the studied group were obese **(Table 1).**

The current study reveals that the home isolation of the studied group during first and second waves of COVID-19 infection

was more than the hospital isolation. Home isolation represented 67.5 % while hospital isolation represented 32.5%. Regarding hospital isolation 20.9 % of patients were isolated in ward while 11.6 % were isolated in ICU; the median length of hospital stay was (7 days) **(Table 2).**

This study demonstrates that there were statistical significance association between non-commitment to the preventive measures and healthy behaviour and increased severity of COVID-19 infection. Patients not committed to regular hand washing had 2.72 times risk higher than those who committed to regular hand washing to be isolated in hospital (OR=2.72 CI; 1.44-5.13; p<0.01), while patients not committed to regular wearing of mask had 1.91 times risk higher to be isolated in hospital than those who committed to it (37.3% vs. 23.7%) respectively (OR=1.91, CI; 1.02-3.60; p<0.05), also patients not committed to cough etiquette had 4.56 times risk for hospital isolation higher than those who committed to it (67.2% vs. 30.9%) respectively (OR=4.56, CI; 2.45-8.52; p<0.01) and patients not committed to regular disinfection of food/objectives had 2.87 times risk higher than others who committed to it to be isolated in hospital (OR=2.87, CI; 1.87-5.58; p<0.01) **(Table 3).**

This study illustrates that there were statistical significance association between co-morbidities among the studied group and severity of COVID-19. Comorbidities were significantly higher in the hospital isolated patients compared to the home isolated patients; cardiac diseases (19.4% vs. 5.8%) respectively (OR=0.25 CI; 0.09-0.64; p<0.01), hypertension (35.8% vs. 12.9%) respectively (OR=0.26, CI; 0.13-0.35; p<0.01) and diabetes (32.8% vs. 15.1%) respectively (OR=0.36, CI; 0.18-0.72; p<0.01) **(Table 4).**

The current study reports significant strong positive correlation between the length of hospital stay and the duration of cigarette smoking (p<0.01) **(Table 5).**

This study reveals that less than half of the studied group received the COVID-19 vaccine. The most common administered vaccine was Sinopharm vaccine (48.4%) followed by Sinovac (26.3%), AstraZeneca (١9.2%) and Jensen vaccine was the least administered one (6.1%) **(Table 6).**

The current study shows that 76.8% of vaccinated participants received the two doses of the vaccine while 23.2% received single dose of vaccine at the time of the study. More than one third of the studied group had a safety concerns about receiving

COVID-19 vaccination and fear of unknown side effects. 3^.4% of participants reported side effects following administration of COVID-19 vaccines **(Table 7).**

Table (1): Socio-demographic data of the study group

Variable		No. N=206	%
Sex:	**Female**	125	60.7
	Male	81	39.3
Residence:	**Rural**	140	68.0
	Urban	66	32.0
Occupation	**Medical**	105	51.0
	Non-medical	101	49.0
Smoking	**Non-smoker**	178	86.4
	X-Smoker	4	1.9
	Smoker	24	11.7
Type of smoking	**Cigarette**	20	83.4
	Goza	2	8.3
	Both	2	8.3
BMI	**Normal**	46	22.3
	Overweight	55	26.7
	Obese	105	51.0
		Median (IQR)	
Age		38.0 (29-56)	
Duration of work in medical field:		9 (6-17)	
Duration of smoking		10 (3-10)	
Number of smoking / day		4 (3-5)	

Table (2): Frequency distribution of the study group according to place of isolation.

Place of isolation		No. N=206	%
Home		139	67.5
Hospital	**Ward**	43	20.9
	ICU	24	11.6
Length of the hospital stay (days) Median (IQR)		7 (5-10)	

Table (3): Association between commitment to preventive measures and healthy behaviour of the studied group and severity of COVID-19 (depending on the place of isolation)

Isolation		Home (N=139)		Hospital (N=67)		Test of sig.	P-value	OR (CI)
preventive measures and healthy behaviour		No.	(%)	No.	(%)			
Regular hand washing	**Yes**	110	79.1	39	58.2	$\chi2$= 15.82	<0.01**	2.72 (1.44-5.13)
	No	29	20.9	28	41.8			
Regular wearing a mask	**Yes**	106	76.3	42	62.7	$\chi2$= 7.69	<0.05*	1.91 (1.02-3.60)
	No	33	23.7	25	37.3			
social distance in closed places	**Yes**	25	18.0	11	16.4	$\chi2$= 5.94	>0.05	1.12 (0.51-2.43)
	No	114	82.0	56	83.6			
Cough etiquette	**Yes**	96	96.1	22	32.8	$\chi2$=28.50	<0.01**	4.56 (2.45-8.52)
	No	43	30.9	45	67.2			
Disinfection of food / objects	**Yes**	63	45.3	15	22.4	$\chi2$=32.33	<0.01**	2.87 (1.47-5.58)
	No	76	54.7	52	77.6			

*significant ** highly significant

Table (4): Association between co-morbidities of the studied group and severity of COVID-19 (depending on the place of isolation).

Isolation		Home (N=139)		Hospital (N=67)		Test of sig.	P value	OR (CI)
		No.	(%)	No.	(%)			
Co morbidities								
Cardiac diseases	**Yes**	8	5.8	13	19.4	$\chi2$=9.20	<0.01**	0.25 (0.09-0.64)
	No	131	94.1	54	80.6			
Hypertension	**Yes**	18	12.9	24	35.8	$\chi2$=14.57	<0.01**	0.26 (0.13-0.35)
	No	121	87.1	43	64.2			
Bronchial asthma	**Yes**	4	2.9	4	6.0	$\chi2$=1.16	>0.05	0.46 (0.11-1.9)
	No	135	97.1	63	94.0			
Diabetes	**Yes**	21	15.1	22	32.8	$\chi2$=8.60	<0.01**	0.36 (0.18-0.72)
	No	118	784.8	45	76.1			
Chronic Liver disease	**Yes**	6	4.3	9	13.4	$\chi2$=5.57	<0.05*	0.29 (0.10-0.85
	No	133	95.6	58	86.6			
Splenomegaly	**Yes**	0.0	0.0	2	3.0	FET=1.66	>0.05	0.0
	No	139	100	65	97.0			

*significant ** highly significant

Table (5): Correlation between the length of hospital stay and certain risk factors.

length of hospital stay	Variable	Correlation Coefficient (rho)*	p –Value
Age		0.25	>0.05
Duration of cigarette smoking (years)		0.95	<0.01**
Duration of working in medical field(years)		0.33	>0.05

***(** rho) = spearman rho **highly significant

Table (6): Vaccination status among the studied group

Vaccination		No. N=206	%
Yes		99	48.1
No		107	51.9
Types of vaccines	**AstraZeneca**	19	١9.2
	Jensen	6	6.1
	Sinopharm	48	48.٤
	Sinovac	26	26.3

Table (7): vaccination against COVID-19 infection of the studied group

Variable		No. N=99	%
Doses received	**One dose**	23	23.2
	Two doses	76	76.8
Side effects of vaccine	**Yes**	38	3٨.4
	No	61	61.6
Causes of non-receiving COVID-19vaccine (N=107)	**Efficacy concerns (vaccine may not be effective)**	2	1.9
	Autonomy and personal freedom	8	7.5
	Ineligibility (pregnant or <16 years old and chronic diseases)	9	8.4
	Distrust in government and health organization	35	32.7
	Preference for physiological immunity (I don`t need it)	16	14.9
	Safety concerns(vaccine is not safe)	37	34.6

Discussion

COVID-19 is a major health problem, it was rapidly emerged in Wuhan city in China in December 2019, it was declared as a global pandemic by WHO on 12 March 2020 [(15)].Egypt was one of the African countries affected by COVID-19 in 2020. By the end of 2020, most of the African countries including Egypt were experiencing fast evolving second wave of the COVID-19 pandemic, reporting a 30% increase in both the weekly incidence and the mean daily new cases [(16)].

Till now the effectiveness of COVID-19 vaccines is questionable and no recommended specific antiviral treatment for COVID-19. Thus we have to study and discuss epidemiological characteristics, risk

factors and severity of different waves of COVID-19.

This study revealed that the median age of the study participants was 38 years, 39.3% of them were males **(Table 1).** These results were supported by a cross sectional study which was conducted on 262 patients from Beijing, The median age of patients was 47.5 years, (48.5%) patients were males [(17).]

In this study we found that nearly half of the studied group was medical workers (51.0%) **(Table 1).** This finding was not similar to a survey study was done in Qatar revealed that the staff members were tested for SARS-CoV-2 (10.6%) most of them were Indian (50.8%) [(18).]This can be explained by exposure of medical group to many risk factors, another explanation was undiagnosed cases during the first wave.

The hospital isolation represented 32.5 % of all confirmed cases in this study (**Table 2).** This finding did not match with a Meta-analysis study which stated that almost 3% of the confirmed cases were admitted to hospitals [(19).]The possible explanation may be related to increased co-morbidities among the studied group

The current study demonstrated that the median length of the hospital stay was 7 days, IQR= (5-10) **(Table 2).** This finding was supported by a Meta-analysis study which reported that the length of hospitalization for the cases in the USA and Italy were (2–10; 1–6) respectively [(19)].

According to this study patients not committed to regular hand washing had 2.72 times risk higher than those who committed to regular hand washing to be isolated in hospital (OR=2.72 CI; 1.44-5.13; p<0.01) **(Table 3)**. These findings were matched with a longitudinal study was done on 1023 individuals residing in the US Which stated that more infect ability were associated with less frequent hand washing [(20).] The possible explanation for these findings may be attributed to, hand washing with soap and water has been recommended as one of the most important measures for prevention of the spread of viruses, including SARS-CoV-2. Decontamination of hands by soap and water involves inactivation (reduction in infectivity) of enveloped viruses [(21).]

This study revealed that that Comorbidities were significantly higher in the hospital isolated patients compared to the home isolated patients; cardiac diseases (19.4% vs. 5.8%) respectively (OR=0.25 CI; 0.09-0.064; p<0.01), hypertension (35.8% vs. 12.9%) respectively (OR=0.26, CI; 0.13-

0.35; p<0.01) and diabetes (32.8% vs. 15.1%) respectively (OR=0.36, CI; 0.10-0.72; p<0.01) **(Table 4)**. These results were similar to a Meta -analysis study which revealed that the presence of comorbidities is associated with severity of COVID-19 infection. The strongest association was observed for cerebrovascular disease, followed by CVD, chronic lung disease, cancer, diabetes, and hypertension [(22)].

Moreover, these findings were supported by a retrospective study on 1590 in china which showed that COVID-19 patients with more types of underlying diseases had a worse prognosis when compared with patients without underlying diseases. Several Studies have reported that, 20–51% of COVID-19 patients have at least one underlying disease, among which diabetes (10–20%) is the most common, followed by hypertension (10–15%) and other cardiovascular and cerebrovascular diseases (7–40%) [(23)].

The current study reported a significant strong positive correlation between the length of hospital stay and duration of cigarette smoking (p<0.01). **(Table 5).** These results were in accordance with WHO which ensured that smokers have a higher risk of developing severe COVID-19 and dying from COVID-19. The WHO emphasizes that smokers' hand-to-mouth behavior and smoke-induced lung diseases may increase their susceptibility to COVID-19[(24)].

In contrast, these findings were not matched with a retrospective cross-sectional study on 91 patients in china which reported that no relationship was found between severity of COVID-19 and smoking [(25)].The possible explanation of the current study results is the suppression of the innate immune cells function, including respiratory epithelium, alveolar surfactant, macrophage, neutrophils, and lymphocytes by tobacco smoking. This could make smokers were more susceptible to develop the complications of COVID-19, such as pneumonia [(26)].

48.1% of the studied group was vaccinated according to this study **(Table 6).** This percentage was higher compared to a survey was conducted in Poland which stated that 37% of the respondents supported COVID-19 vaccinations [(27)]**.** This can be explained by obligatory vaccination against COVID-19 infection in Egypt.

The most common administered vaccine was Sino pharm (48.4%) vaccine followed by Sinovac (26.3%) and AstraZeneca (١9.2%) **(Table 6).** These results were in

contrast to a cross sectional study which was done in Jordan on 1,086 participants revealed that 33.0% received AstraZeneca vaccine and 26.4% received Sino pharm vaccine only **(28).** The possible explanation may be attributed to increased provision of sino-pharm and Sinovac vaccine by the Egyptian governorate.

More than one third (34.6) of the studied group in this study had a safety concerns about receiving COVID-19 vaccination and fear of unknown side effects **(Table 7).** This finding was supported by a cross sectional on line survey was carried out in Italy on 1011 participants which illustrated that The most common concerns about the COVID-19 vaccine was safety (54%) **(29).**

Study limitations:

There were certain limitations in this study as:

- Recall bias.
- Fear of stigma

Conclusion:

It was noticed that there was strong relation between smoking and the length of hospital stay. The need for hospital isolation was increased in patients with comorbidities as Cardiac diseases, hypertension and diabetes and patients who were not committed to preventive measures and healthy behaviour.

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