Clinical Presentation, Management and Outcome of Staffs with COVID-19 Disease: a large tertiary Oil and Refinery Grand Hospital Study

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Abstract

Objective

The aim of the present study was to assess clinical characteristics, managing and controlling, and in-hospital outcome of COVID-19 among oil refinery workers in a single referral center.

Methods

This cross-sectional study was conducted in a non-COVID single referral center from March to August 2020. At the Naft grand Hospital, the COVID-19 specimen collection and molecular detection unit was established with staff trained to collect suitable samples (sufficiently deep swabs), storage, packaging, and transportation. The diagnosis of COVID-19 infection (SARS-CoV-2) was confirmed by real-time reverse transcription polymerase chain reaction (RT-PCR) assay.

Results

Overall, 500 patients with confirmed COVID-19 infection were included, of which the most common comorbidities were hypertension (52.2%) and diabetes (45.6%). Moreover, 298 patients (59.6%) had one to three comorbidities, 148 patients (29.6%) had four to six cases, and two patients (0.4%) had seven and more comorbidities. Finally, 23 people (4.6%) have cancer and 206 people (41.2%) have other diseases. 390 (78.8%) received Kaletra, and 387 (78.02%) receive Azithromycin. Overall, PCR test result was positive in 377 (75.4%) patients, computed tomography scan (CT-scan) test was positive in 413 (82.6%) patients, and CRP test had positive result in 335 patients (67%) patients.

Conclusion

Most referred cases were survivors with mild to moderate symptoms, and a few of them were unfortunately non-survivor. This could be due to those people with mild COVID-19 symptoms may respond well to the treatment and institutional isolation. Thus, good and evidence-based clinical care combined with strong public health interventions will save the lives of thousands, if not millions, worldwide.

Introduction

The novel coronavirus, the seventh known virus in the family, was named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) on February 11, 2020, according to the World Health Organization (WHO). COVID-19 is also a contagious disease caused by SARS-CoV-2. Most people with COVID-19 develop mild respiratory illness and recover without the need for special care or treatment. Older people and those with underlying diseases such as cardiovascular disease, diabetes, chronic respiratory disease

and cancer are more likely to develop COVID-19 [1, 2]. The SARS-CoV-2 is transmitted primarily through saliva droplets or nasal secretions during sneezing and coughing [3]; so practicing breathing habitude (such as coughing at the elbow) is very important. There is currently no specific vaccine or treatment for COVID-19, but clinical trials are ongoing to obtain possible treatment [4].

It is reported that enacting social distance policies at the national level is associated with a significant reduction in the transmission of SARS-CoV-2, which reduces the rate of viral transmission, as well as COVID19 infection rates [5]. The WHO works closely with experts, governments and global partners to rapidly expand scientific knowledge about SARS-CoV-2 and, with timely recommendations, take steps to protect public health and prevent its spread.

The apparently risk of COVID-19 infection among different oil refinery workers may be due to lack of awareness, inadequate protective measures, and contact with infected people in the community or hospital and treatment environments. Thus, the aim of the present study was to assess clinical characteristics, managing and controlling, and in-hospital outcome of COVID-19 among oil refinery workers in a single referral center.

Methods

Study design, setting, and population

This cross-sectional study was conducted in a non-COVID single referral center (Naft grand hospitals, Ahvaz, Iran) from March to August 2020. This study was approved by the Naft grand hospital Institutional Review Board (IRB) and signed consent was obtained from all included subjects prior to enrollment.

Specimen collection process

At the Naft grand Hospital, the COVID-19 specimen collection and molecular detection unit was established with staff trained to collect suitable samples (sufficiently deep swabs), storage, packaging, and transportation. Trained laboratory personnel collected nasal swabs using standard techniques based on health and safety standard protocols. After collection, swabs containing the sample were placed immediately into a sterile transport tube containing the viral transport medium and delivered to the laboratory. The diagnosis of COVID-19 infection (SARS-CoV-2) was confirmed by real-time reverse transcription polymerase chain reaction (RT-PCR) assay.

Statistical analysis

Baseline patient characteristics, treatments, and clinical course were presented as frequencies with percentages for categorical variables, and as the mean with standard deviation for continuous variables. Categorical variables were compared using the Chi-square test, although Fisher's exact test was used when the data were sparse. Continuous variables were compared using the Mann-Whitney or Kruskal-

Wallis tests. All tests were two-tailed, and results with P values < 0.05 were considered statistically significant. All data preparation and statistical analyses were conducted by using SPSS 22.

Results

Overall, 500 patients with confirmed Covid-19 were included in this study. In total, 375 (75%) of the patients live in metropolitan area and 125 (25%) live in urban areas. 286 people (53.6%) are men and 232 people (46.4%) are women. The highest and lowest frequencies are related to the age group of 60 to 75 and over 75 years with a frequency of 260 people (52%) and 51 people (10.2%), respectively. The highest and lowest levels of education are related to the level of illiteracy and diploma education with frequencies of 80 people (16%) and 59 people (11.8%), respectively and 255 people (51%) did not determine their education. 116 people (23.2%) are unemployed and 324 people (64.8%) are employed. Employment status was unknown in 60 (12%) subjects. The most commonly symptoms on admission were dyspnea (56.0%), cough (50.4%), and fever (49.0%). 144 patients (28.8%) had underlying diseases. The most common comorbidities were hypertension (52.2%) and diabetes (45.6%). Moreover, 298 patients (59.6%) had one to three comorbidities, 148 patients (29.6%) had four to six cases, and two patients (0.4%) had seven and more comorbidities. Finally, 23 people (4.6%) have cancer and 206 people (41.2%) have other diseases. 390 (78.8%) received Kelatra, and 387 (78.02%) receive Azithromycin. Overall, PCR test result was positive in 377 (75.4%) patients, Computed Tomography scan (CT-scan) test was positive in 413 (82.6%) patients, and CRP test 335 patients (67%) patients had positive result. Of the 55 (11% of total) non-survivor patients 33 (60.0%) were male. 56.4% of the non-survivors were at 65–75 years age group. The majority of non-survived patients had HTN; 34 (61.8%), as well as 80% were received Kelatra as treatment. The demographic and clinical characteristics of patients according to their final status (survivor/ Non-survivor) are shown in Table 1.

Table 1
Demographic and clinical characteristics, radiographic, laboratory results of patients with COVID-19.

Variables	Overall Patients (n = 500)	Survivor (n = 445)	Non-survivor (n = 55)	P
Demographic				
Gender; n (%)				0.321
Female	232 (46.4)	210 (47.2)	22 (40)	
Male	268 (53.6)	235 (52.8)	33 (60)	
Age group; n (%)				< .0001
< 40	24 (4.8)	23 (5.2)	1 (1.8)	
41–59	165 (33)	156 (35.1)	9 (16.4)	
60–75	260 (52)	229 (51.5)	31 (56.4)	
> 75	51 (10.2)	37 (8.3)	14 (25.5)	
Clinical history				
Diabetes; n (%)	228 (45.6)	127 (28.5)	17 (30.9)	0.753
CVD; n (%)	188 (37.6)	161 (36.2)	27 (49.1)	0.076
HTN; n (%)	261 (52.2)	227 (51)	34 (61.8)	0.153
Cancer; n (%)	23 (4.6)	17 (3.8)	6 (10.9)	0.031
Other disease; n (%)	206 (41.2)	174 (39.1)	32 (58.2)	0.009
Number of comorbidity; n (%)				0.001
No disease	52 (10.4)	49 (11)	3 (5.5)	
1–3	298 (59.6)	275 (61.8)	23 (41.8)	
4–6	148 (29.6)	120 (27)	28 (50.9)	
7+	2 (0.4)	1 (0.2)	1 (1.8)	
Diagnosis				
PCR result; n (%)				0.754
Positive	377 (75.4)	334 (75.1)	43 (78.2)	
Negative	117 (23.4)	106 (23.8)	11 (20)	
Unknown	6 (1.2)	5 (1.1)	1 (1.8)	
CT result; n (%)				0.842

Variables	Overall Patients (n = 500)	Survivor (n = 445)	Non-survivor (n = 55)	P
Positive	413 (82.6)	366 (82.2)	47 (85.5)	
Negative	25 (5)	23 (5.2)	2 (3.6)	
Suspicious	29 (5.8)	27 (6.1)	2 (3.6)	
Unknown	33 (6.6)	29 (6.5)	4 (7.3)	
Effective PCR result; n (%)	461 (92.2)	413 (92.8)	48 (87.3)	0.177
Effective CT result; n (%)	461 (92.2)	411 (92.4)	50 (90.9)	0.603
Effective clinical diagnosis; n (%)	167 (33.4)	147 (33)	20 (36.4)	0.651
Effective laboratory results; n (%)	477 (95.4)	427 (96)	50 (90.9)	0.160
Symptoms				
Fever; n (%)	245 (49)	220 (49.4)	25 (45.5)	0.668
Cough; n (%)	252 (50.4)	231 (51.9)	21 (38.2)	0.063
Dyspnea; n (%)	280 (56)	247 (55.5)	33 (60)	0.567
Myoliagia; n (%)	79 (15.8)	73 (16.4)	6 (10.9)	0.334
Anorexia; n (%)	57 (11.4)	53 (11.9)	4 (7.3)	0.375
Diarrhea; n (%)	30 (6)	26 (5.8)	4 (7.3)	0.559
Headache; n (%)	29 (5.8)	26 (5.8)	3 (5.5)	> 0.99
Sore Throat; n (%)	12 (2.4)	11 (2.5)	1 (1.8)	> 0.99
Olfactory.dis; n (%)	12 (2.4)	10 (2.2)	2 (3.6)	0.631
Nausea; n (%)	46 (9.2)	43 (9.7)	3 (5.5)	0.457
Fatigue; n (%)	148 (29.6)	130 (29.2)	18 (32.7)	0.639
Other symptoms; n (%)	11 (22.2)	89 (20)	22 (40)	0.002
Laboratory result				
Normal LDH; n (%)	118 (23.6)	115 (48.9)	3 (13)	0.001
Lymph	24.42 ± 12.94	25.07 ± 12.74	18.90 ± 13.42	< .001
PMN	57.46 ± 12.76	57.62 ± 12.28	56.10 ± 16.24	0.523
Hb	12.08 ± 1.94	12.15 ± 1.93	11.51 ± 1.97	0.022

Variables	Overall Patients (n = 500)	Survivor (n = 445)	Non-survivor (n = 55)	P
WBC	7744.54 ± 4438.05	7528.69 ± 4287.91	9490.91 ± 5229.06	0.012
Platelet	216.03 ± 81.33	214.90 ± 78.45	255.18 ± 102.11	0.794
Treatment				
Kelatra; n (%)	390 (78.8)	346 (78.6)	44 (80)	> .99
Azithro; n (%)	387 (78.02)	357 (81.1)	30 (54.5)	< .0001
Hydroxychloroquine; n (%)	142 (28.6)	131 (29.7)	11 (20)	0.155
Remdesivir; n (%)	7 (1.41)	6 (1.3)	1 (1.8)	0.564
Interferon; n (%)	3 (0.6)	2 (0.5)	1 (1.8)	0.298
Corton; n (%)	22 (4.4)	8 (3.2)	8 (14.5)	0.001
IVIG; n (%)	2 (0.4)	1 (0.2)	1 (1.8)	0.210

To explore age-related differences a subgroup analysis was performed, stratifying by age as ≤ 40 year-old, between 41 and 59 year- old, between 60 and 75 year-old or > 75 year-old. Final status were different between the age-groups ($p < .001$). Approximately, older patients with COVID-19 had a higher proportion of comorbidities in comparison with younger patients. HTN was the most common comorbidity in the last three age groups, nevertheless it was less frequent in the younger group compared with the older groups ($P < .0001$). Distribution of other variables according to age groups are presented in Table 2.

Table 2
Demographic and clinical characteristics, radiographic, laboratory results of patients with COVID-19 according to age group.

Variables	< 40 (n = 24)	41–59 (n = 165)	60–75 (n = 260)	75+ (n = 51)	P
Demographic					
Gender; n (%)					0.864
Female	12 (50)	87 (52.7)	139 (53.5)	30 (58.8)	
Male	12 (50)	78 (47.3)	121 (46.5)	21 (41.2)	
Final status; n (%)					< .001
Survived	23 (95.8)	156 (94.5)	229 (88.1)	37 (72.5)	
Dead	1 (4.2)	9 (5.5)	31 (11.9)	14 (27.5)	
Clinical history					
Diabetes; n (%)	1 (4.2)	67 (40.6)	136 (52.3)	24 (47.1)	< .0001
CVD; n (%)	2 (8.3)	40 (24.2)	113 (43.5)	33 (64.7)	< .0001
HTN; n (%)	1 (4.2)	68 (41.2)	158 (60.8)	34 (66.7)	< .0001
Cancer; n (%)	0 (0)	6 (3.6)	15 (5.8)	2 (3.9)	0.499
Other disease; n (%)	6 (25)	54 (32.7)	117 (45)	29 (56.9)	0.003
Number of comorbidity; n (%)					< .0001
No disease	11 (45.8)	27 (16.4)	13 (5)	1 (2)	
1–3	7 (29.2)	108 (65.5)	157 (60.4)	26 (51)	
4–6	6 (25)	29 (17.6)	90 (34.6)	23 (45.1)	
7+	0 (0)	1 (0.6)	0 (0)	1 (2)	
Diagnosis					
PCR result; n (%)					0.717
Positive	19 (79.2)	126 (77.8)	198 (76.7)	34 (68)	
Negative	5 (20.8)	36 (22.2)	60 (23.3)	16 (32)	
Unknown	0 (0)	3 (1.8)	2 (0.8)	1 (2)	
CT result; n (%)					0.335
Positive	22 (100)	142 (91.6)	210 (87.1)	39 (79.6)	

Variables	< 40 (n = 24)	41–59 (n = 165)	60–75 (n = 260)	75+ (n = 51)	P
Negative	0 (0)	7 (4.5)	13 (5.4)	5 (10.2)	
Suspicious	0 (0)	6 (3.9)	18 (7.5)	5 (10.2)	
Unknown	2 (8.3)	10 (6.1)	19 (7.3)	2 (3.9)	
Effective PCR result; n (%)	23 (95.8)	156 (94.5)	236 (90.8)	46 (90.2)	0.436
Effective CT result; n (%)	22 (91.7)	155 (93.9)	236 (90.8)	48 (94.1)	0.636
Effective clinical diagnosis; n (%)	10 (41.7)	62 (37.6)	77 (29.6)	18 (35.3)	0.285
Effective laboratory results; n (%)	23 (95.8)	159 (96.4)	248 (95.4)	47 (92.2)	0.664
Symptoms					
Fever; n (%)	16 (66.7)	92 (55.8)	115 (44.2)	22 (43.1)	0.028
Cough; n (%)	11 (45.8)	97 (58.8)	120 (46.2)	24 (47.1)	0.074
Dyspnea; n (%)	14 (58.3)	91 (55.2)	150 (57.7)	25 (49)	0.703
Myoliagia; n (%)	5 (20.8)	36 (21.8)	31 (11.9)	7 (13.7)	0.045
Anorexia; n (%)	4 (16.7)	17 (10.3)	29 (11.2)	7 (13.7)	0.766
Diarrhea; n (%)	3 (12.5)	8 (4.8)	18 (6.9)	1 (2)	0.256
Headache; n (%)	5 (20.8)	6 (3.6)	17 (6.5)	1 (2)	0.005
Sore Throat; n (%)	0 (0)	3 (1.8)	8 (3.1)	1 (2)	0.710
Olfactory.dis; n (%)	1 (4.2)	4 (2.4)	5 (1.9)	2 (3.9)	0.783
Nausea; n (%)	2 (8.3)	18 (10.9)	24 (9.2)	2 (3.9)	0.513
Fatigue; n (%)	5 (20.8)	53 (32.1)	75 (28.8)	15 (29.4)	0.691
Other symptoms; n (%)	6 (25)	29 (17.6)	65 (25)	11 (21.6)	0.342
Laboratory result					
Normal LDH; n (%)	6 (25)	42 (25.5)	58 (22.3)	12 (23.5)	0.923
Lymph	29.85 ± 15.01	25.81 ± 11.27	24.03 ± 13.89	20.64 ± 11.40	0.016
PMN	54.58 ± 11.41	58.27 ± 12.15	57.25 ± 12.89	55.84 ± 14.53	0.457

Variables	< 40 (n = 24)	41–59 (n = 165)	60–75 (n = 260)	75+ (n = 51)	P
Hb	13.01 ± 1.78	12.38 ± 1.89	11.87 ± 1.97	11.71 ± 1.80	0.016
WBC	7170.83 ± 2770.72	6837.03 ± 2926.97	8015.22 ± 4729.88	9570.59 ± 6511.01	0.006
Platelet	201.70 ± 72.49	222.41 ± 79.74	213.18 ± 83.94	216.66 ± 77.24	0.347

Discussion

Our study was based in a large tertiary oil and refinery grand hospital in Southwestern Iran, which is a non-COVID hospital; however, in the course of the COVID-19 pandemic, several patients were consequently diagnosed with COVID-19 infection. The most predominant comorbidity associated with COVID-19 related adverse events was hypertension following with diabetes. Our findings was in line with other recent reports. Sanyaolu *et al*, in a recent systematic review examined the comorbid conditions in patients infected with the ongoing COVID-19 disease, and reported hypertension following with cardiovascular disease and diabetes as the most common comorbidities identified in these patients [6]. Richardson *et al*, in a larger case series of patients with COVID-19 in 12 hospitals also reported the most common comorbidities as hypertension, following by obesity and diabetes [7]. One of possible reason why individuals with hypertension are at a higher risk of death due to COVID-19, is that a well-functioning immune system could help people to better combat this disease without too many adverse effects [8]. Another possible hypothetical reason is treatment with angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARBs) [9]. This hypothesis is based on the fact that ACE inhibitors and ARBs increase the level of angiotensin-converting enzyme-2 (ACE2) in the body. Although no scientific evidence has been provided so far, to infect cells, the COVID-19 attaches to the ACE2 [10].

Moreover, in the present study the frequent age group was 60 to 75 years. As older adults are at higher risk for severe diseases than younger people, similarly, people at age of 60 and above are, in general, at higher risk for severe adverse events related to COVID-19. Perez-Saez *et al*, estimated a relatively high infection fatality risk (IFR) for people with COVID-19 aged 65 and older [11]. Mueller *et al*, present the molecular differences between younger and older ages, as well as several biological age clocks and genetic differences, which may explain why the chance of getting severely form of COVID-19 increases with age [12]. This fact can be explained by both the physiological changes occur with aging in the human body and, in particular, the higher prevalence of mortality and comorbidities in older adults who contribute to a low functional reserve that reduces intrinsic ability and flexibility and impedes the ability to control the COVID-19 infection [13–15].

Most of the patients had positive Real-time polymerase chain reaction (RT-PCR) and chest computed tomography (CT) scan results. The difference between survivors and non-survivors was not statistically significant in term of PCR and chest CT-scan results. This could be interpreted as that, thought making

the ultimate COVID-19 diagnosis based on both RT-PCR and CT scan findings is recommended, none of the two detection techniques are reliable alone and may not reveal the severity of the disease [16, 17].

The most accompanied symptoms included of referred patients in the present study were cough, dyspnea, and fever. Previous studies have reported fever in 99% of people during the course of COVID-19 disease, but most importantly in a single cohort, it was reported that this complication at the time referring to hospital presented in only 44% of patients and in some cases even up to 89% were reported during hospitalization [18]. Other common symptoms such as cough, shortness of breath may occur in 10% of patients [19]. In the present study, most frequent medications include kaletra (lopinavir/ritonavir), azithromycin, and hydroxychloroquine, of which azithromycin was more significantly potent in survivor group than non-survivors. In this context, the pervasive clinical evidences and existing literature on antiviral mechanisms of lopinavir/ritonavir and hydroxychloroquine or azithromycin in the treatment of previous epidemic viral diseases, suggested that these combinations may be helpful in the combat with COVID-19 infection [20–25]. Available evidences propose that these antiviral medications can target the RNA polymerase and block viral RNA synthesis, as well as target the chymotrypsin-like protease (3CLpro), a major coronavirus protease [26, 27], but the clinical effects are controversial [28].

Conclusion

Most referred cases were survivors with mild to moderate symptoms, and a few of them were unfortunately non-survivor also. This could be due to that people with mild COVID-19 symptoms may responds well to the treatment and institutional isolation. COVID-19 disease not only has created a global epidemic that has had a major impact on public health and changed the daily lives of billions of people, but it has also revealed the weakness of strong, well-resourced international health systems. Moreover, it has had a wide and sometimes irreparable economic impact. Advances in the field of medical diagnosis and treatment, such as new and rapid diagnosis, specific effective treatments, and preventive vaccines are among the priorities that have really received a lot of attention. At the same time, good and evidence-based clinical care combined with strong public health interventions will save the lives of thousands, if not millions, worldwide.

Declarations

Ethics approval and consent to participate

This study was approved by the Naft grand hospital Institutional Review Board (IRB) and signed consent was obtained from all included subjects prior to enrollment.

Consent for publication

Not applicable.

Availability of data and material

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

BD, AA and FR designed the study. SS conducted the survey. EM, SS and FR conducted the analysis. FR drafted the manuscript. AA, AS and FR contributed to revisions with important intellectual content. All authors accepted the final version of the manuscript. All authors had full access to all data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. The authors read and approved the final manuscript.

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