Original Article:
A Survey on the First 100 COVID-19 Patients Admitted to a Referral Center in Northern Iran in Early 2020

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Article info:
Received: 22 Apr 2021
Accepted: 15 Jun 2021

Keywords:
Coronavirus, COVID-19, Iran, Epidemiology, Clinical

ABSTRACT

Background: Lymphopenia is an important but nonspecific laboratory indicator of COVID-19.

Objectives: To describe epidemiologic and clinical characteristics of the first cases of the COVID-19 referred to a center dedicated to COVID-19 patients in Iran.

Methods: This research is a retrospective cross-sectional study on 100 confirmed cases with COVID-19, hospitalized from February 25 to March 10, 2020, in Qaemshahr Razi Hospital in Mazandaran Province, Iran. The main demographic data, clinical features, including outcomes, laboratory findings, and therapeutic protocols, were collected in a structured form and analyzed.

Results: The Mean±SD age of the patients was 56.7±15.6 years. Fifty-nine percent (n=59) of the patients were male. Nineteen percent (n=19) were admitted to the ICU. The median (IQR) time from disease onset to hospital admission was 5 (3-7) days. The most common symptoms were fever (73%), dyspnea (67%), dry cough (61%), and myalgia (61%). The severity of the disease was moderate in most patients (n=54). The average hospital stay for patients was 7 days. The non-survivor cases in comparison to survived ones were from a higher age group (65 vs 52 years; P=0.001), had a higher frequency of underlying diseases (68.4% vs 39.5%; P=0.039), had a lower peripheral capillary O2 saturation at the time of admission (79% vs 94%; P<0.001), and were more likely to have lymphopenia (63.2% vs 37%; P=0.034).

Conclusion: Lymphopenia, increased neutrophil to lymphocyte ratio and decreased peripheral capillary O2 saturation are commonly seen in COVID-19 patients, especially among severe cases, and can be used in developing clinical prediction rules.

1. Introduction

The new coronavirus 2019 (COVID-19) epidemic began in early December 2019 in Wuhan, Hubei Province, China [1]. It is one of the largest epidemics of the last century. With a remarkable doubling rate [2], after catastrophic dissemination to almost all countries worldwide, COVID-19 has become one of the largest pandemics ever experienced by humans. The first confirmed case in Iran was reported in Qom City, central of Iran, on February 19, 2020 [3], and it has now been disseminated in all

Citation Abbaspour Kasgari H, Moradi S, Babamahmoodi F, Shabani AM, Davoodi L, Davoudi Badabi AR. A Survey on the First 100 COVID-19 Patients Admitted to a Referral Center in Northern Iran in Early 2020. Pharmaceutical and Biomedical Research. 2022; 8(1):31-42. http://dx.doi.org/10.18502/pbr.v8i1.9386

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provinces of the country. According to WHO reported cases and deaths of laboratory-confirmed COVID-19, the number of people infected with the disease has risen to more than 73000. Also, the number of fatalities has increased to more than 4500 by April 14, 2020, in Iran [4]. The cardinal clinical manifestations of COVID-19, like other coronavirus infections, include a wide range of symptoms, including fever, rhinorrhea, cough, headache, fatigue, shortness of breath, and gastrointestinal symptoms [5]. In addition, the most important but nonspecific laboratory indices of this infection are lymphopenia, increased prothrombin time, and disturbed serum level of lactate dehydrogenase [6]. Regarding the treatment of COVID-19 disease, although a definitive therapeutic regimen has not been introduced, several protocols with different effectiveness have been used empirically in various clinical settings worldwide [7]. Also, preprint research using meta-analysis introduced acute respiratory distress syndrome (ARDS) as a frequent clinical outcome among severe cases. This preliminary analysis estimated that the mortality rate of patients with COVID-19 infection is around 6.4% [8]. Because of the diversity and multiplicity of clinical findings and laboratory profiles and treatment protocols in different contexts, we intend to investigate the epidemiological, clinical, laboratory, and therapeutic characteristics of COVID-19 patients hospitalized in Razi Hospital, one of the largest infectious disease referral centers in northern Iran in the early phase of the epidemic.

2. Patients and Methods

Study Design and Participants

This cross-sectional study was conducted on 100 hospitalized patients with COVID-19 in Qaemshahr Razi Hospital in Mazandaran Province, Iran, from February 25 to March 10, 2020. Patients with chief complaints of fever, cough, shortness of breath, and sometimes gastrointestinal symptoms suspected of having coronavirus infection entered the study. According to the national standard protocol to confirm the presence of coronavirus, a sample of patients' respiratory secretions was sent for RT-PCR testing, and the results were recorded. Because it takes 3 days to receive the RT-PCR test result, patients with strong evidence of infection in the lung CT scan, including ground-glass opacity in the peripheral areas of the lungs, were also considered positive. After the disease was confirmed, the patients were treated with antiviral and antibiotic medications. They received supportive care, and their clinical outcomes, such as the length of hospital stay and the mortality/recovery rate, were followed up till March 24, 2020, and were recorded in the data collection form. Also, demographic data, including age, sex, height, and weight, and the results of laboratory tests of patients, such as complete blood count, coagulation profile, renal and liver function tests, and blood electrolytes, were recorded in the data collection form [9]. This research achieved Mazandaran University of medical sciences Ethics Committee approval code of IR. MAZUMS, REC.1398.1436. Also, we used the STROBE (The Strengthening the Reporting of Observational Studies in Epidemiology) cross-sectional reporting guidelines to check our manuscript.

Sample Size

According to a meta-analysis performed by Pengfei et al. in China, published by Lancet [8], in which the prevalence of ARDS in COVID-19 patients was estimated at 15% (P), with a 95% confidence interval (Z=1.96) and the maximum β error of 7% (d), the minimum sample size was 100 confirmed COVID-19 patients based on the following formula:

$$N=Z2\ P\ (1-P)/d2$$

Data Analysis

Initially, the distribution of quantitative variables was examined by the Kolmogorov-Smirnov test and histogram drawing. Then, we used Mean±SD and median (interquartile range) to describe quantitative variables and the frequency (percentage) for qualitative variables. For inferential analysis, depending on the data distribution, the average of variables was tested using the independent t test or its non-parametric equivalent, the Mann-Whitney U test. Also, the frequency of categorical variables was compared using the χ^2 test or Fisher Exact test when needed. The descriptive and analytical findings were extracted from IBM, SPSS v. 25 software. In all analyses, a 2-sided P value ≤0.05 was considered as a benchmark of statistical significance of results.

3. Results

In this cross-sectional study, the disease information of 100 patients was analyzed. The Mean±SD age of the patients was 56.7±15.6 years, and their minimum and maximum ages were 20 and 98 years. Fifty-nine percent (n=59) of patients were male and 41% (n=41) were female. Nineteen percent (n=19) of the patients were admitted to ICU, and the remaining 81% (n=81) to the isolation ward. The baseline characteristics of patients are summarized in Table 1. Although ICU patients compared to those admitted to the isolation ward were from older

age groups (57.8% vs 32.1% over 60 years of age). Most ICU patients were female (57.9% vs 37% in the isolation ward group), the differences were not statistically significant (P≥0.2 and P=0.08, respectively). Besides, the frequency of underlying comorbidities in patients admitted to ICU was higher than those admitted to the isolation ward (68.4% vs 39.5%; P=0.02). Cardiovascular diseases were more common in patients admitted to ICU (30.7% vs 18.7% in isolation ward group), while in patients hospitalized in an isolation ward, hypertension and diabetes mellitus were more important (62.5% vs 38.5% and 53.1% vs 23%, respectively). These differences were statistically significant (P<0.001).

Clinical features and main outcomes of patients are presented in Table 2. The median (IQR) of time from disease onset to hospital admission was 5 (3-7) days, and this time was similar among both those admitted to ICU and the patients admitted to an isolation ward. Fever (78.9% vs 71.6%), dyspnea (78.9% vs 64.2%), dry cough (68.4% vs 59.3%), and myalgia (68.4% vs 59.3%) were the most common symptoms among both ICU and isolation ward admitted patients, respectively. The severity of the disease was moderate in most patients (n=54), and patients admitted to ICU suffered from moderate to severe illness in 100% of cases. In contrast, one-third of patients admitted to the isolation ward had mild disease. Of the vital signs, only the average oxygen saturation was significantly different between the two groups and was lower among patients admitted to ICU (78.5% vs 94%). Thirty-five percent (n=35) of patients developed organ failure, which was more common in ICU patients (52.6% vs 30.9%). Among the various types of organ failure, heart dysfunction was the most common problem in patients admitted to the isolation ward (23% of patients); ARDS and heart dysfunction were equally common (both in 15.8% of patients) in ICU patients. The differences in the frequency of different types of organ failure in the two groups of patients were statistically significant (P=0.001). The average hospital stay for patients was 7 days, and this period was significantly longer for patients admitted to ICU than isolation ward (11 days vs 6 days). Also, 9 patients were intubated, all hospitalized in the ICU. Finally, most of the deceased cases were admitted to ICU (84.2% vs 3.7% in the isolation ward group).

Laboratory tests results of patients are presented in Table 3. Of the CBC (complete blood count) indices, lymphopenia was detected in 42% of patients (n=42). In ICU patients, the reduction in the absolute number of lymphocytes and the increase in the ratio of neutrophils to lymphocytes (NLR) were significantly different from patients admitted to the isolation ward (12% vs 24%, and 6 vs 2.9, respectively). Also, in 42% of patients (n=42), a decrease in hemoglobin was observed. Decreased hemoglobin was more common in patients admitted to ICU (73.7% vs 34.6%). Hypernatremia as an electrolyte disorder was observed in 10% of patients, most of whom were hospitalized in ICU.

The bleeding disorder was also more common in patients with critical conditions, with prolonged prothrombin time (14.4 vs 13.5 s) and increased international normalized ratio (INR) (1.34 vs 1.21). The patients' hepatic and renal functions were also evaluated. Disorders of the hepatic aminotransferases were observed in less than a quarter of patients and had little relation to the critical condition of the patients. However, impaired renal function was confirmed in patients admitted to ICU with higher BUN and creatinine than in other patients (47 vs 27.5 and 1.1 vs 0.9).

Finally, regarding inflammatory markers, increased erythrocyte sedimentation rate (ESR) and positive C-reactive protein (CRP) were seen in 86% and 67% of patients, respectively. Failure to measure CRP for 20% of patients made some difficulty in the interpretation of its level among patients with critical situations because, unlike ESR, which has a meaningful higher average among ICU patients (68.5 vs 59), the frequency of positive CRP in ICU patients were fewer than patients admitted to isolation ward (31.6% vs 75.3%).

The epidemiological, clinical, and paraclinical findings of non-survivor cases compared to survived ones are listed in Table 4. As it can be seen, the deceased belonged to higher age groups (65 y vs 52 y), had a higher frequency of underlying diseases (68.4% vs 39.5%), had a more severe illness (78.9% vs 8.6%), had a lower oxygen saturation at the time of admission (79% vs 94%), and were more likely to have lymphopenia (63.2% vs 37%). They also had a longer INR index (1.3 vs 1.2). There was evidence that the ESR (68.5 vs 59) and NLR index (5.8 vs 2.5) were higher among deceased ones, although these findings did not have a high statistical significance (P=0.055 and P=0.092, respectively). Given what has been said in the previous paragraph, it is not easy to make a comparative judgment about the CRP situation.

Finally, the therapeutic regimens prescribed for patients are presented in Table 5. As seen, the most common antiviral regimen were hydroxychloroquine (HCQ)+oseltamivir (35%), HCQ+oseltamivir+Kaletra (24%), and HCQ+Kaletra (10%). Also, antibiotics have been prescribed to treat possible concomitant bacterial

Table 1. Baseline characteristics of 100 COVID-19 patients admitted to RAZI infectious disease referral center, Northern Iran

Variables		Mean±SD/No. (%)			P
		Total (N=100)	ICU (n=19)	Isolation Ward (n=81)	
		56.7±15.6	60.5±17.3	53.4±15	0.07
Age groups (y)	Less than 10	0(0)	0(0)	0(0)	>0.2
	11-20	1(1)	0(0)	1(1.2)	
	21-30	6(6)	2(10.5)	4(4.9)	
	31-40	15(15)	0(0)	15(18.6)	
	41-50	14(14)	2(10.5)	12(14.8)	
	51-60	27(27)	4(21.2)	23(28.4)	
	61-70	22(22)	7(36.8)	15(18.6)	
	71-80	9(9)	2(10.5)	7(8.6)	
	More than 80	6(6)	2(10.5)	4(4.9)	
Gender	Male	59(59)	8(42.1)	51(63)	0.08
	Female	41(41)	11(57.9)	30(37)	
History of exposure	Close contact	66(66)	14(73.7)	52(64.2)	>0.2
	Healthcare workers	23(23)	2(10.5)	21(25.9)	
	Travel	3(3)	1(5.3)	2(2.5)	
	Close contact and travel	8(8)	2(10.5)	6(7.4)	
Comorbidity	Yes	45(45)	13(68.4)	32(39.5)	0.02
	No	55(55)	6(31.6)	49(60.5)	
Main comorbidities	Hypertension	26(57.7)	5(38.5)	20(62.5)	<0.001
	Diabetes mellitus	20(44.4)	3(23)	17(53.1)	
	Cardiovascular disease	13(28.8)	4(30.7)	6(18.7)	
BMI	Normal	44(44)	8(42.1)	34(41.9)	>0.2
	Overweight	56(56)	11(57.9)	41(58.1)	

BMI: Body Mass Index; ICU: Intensive Care Unit.

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pneumonia, and the most common of these were ceftriaxone (48%), levofloxacin (32%), and azithromycin (25%).

4. Discussion

To our knowledge, this is the first research that investigated epidemiologic, clinical, paraclinical, and therapeutic features of a reasonable sample size of COVID-19 patients admitted to a referral center in the north of Iran. The study started on February 25, 2020, when the first confirmed COVID-19 patient was admitted to the hospital, and continued until March 10, 2020, when the 100th patient was admitted. The main epidemiological features of patients were as follows.

They were mainly from older age groups, and only one of them was less than 20. Approximately 60% of patients were male, and more than two-thirds of them reported close contact with a confirmed case of COVID-19. Also, more than 20% of the patients were healthcare workers,

Table 2. Clinical features and outcomes of 100 COVID-19 patients admitted to RAZI infectious disease referral center, Northern Iran

Variables		No.(%)			P
		Total (N=100)	ICU (n=19)	Isolation Ward (n=81)	
Onset of symptoms to admission(day), Median(IQR)		**5(3-7)**	**5(3-7)**	**5(3-7)**	
Symptoms at admission	Fever	73(73)	15(78.9)	58(71.6)	>0.2
	Dyspnea	67(67)	15(78.9)	52(64.2)	
	Dry cough	61(61)	13(68.4)	48(59.3)	
	Myalgia	61(61)	13(68.4)	48(59.3)	
	Nausea and vomiting	26(26)	4(21.1)	22(27.2)	
	Fatigue	18(18)	3(15.8)	15(18.5)	
	Headache	17(17)	3(15.8)	14(17.3)	
	Diarrhea	9(9)	0(0)	9(11.1)	
	Productive cough	8(8)	2(10.5)	6(7.4)	
	Anosmia	5(5)	2(10.5)	3(3.7)	
	Loss of appetite	5(5)	2(10.5)	3(3.7)	
	Diaphoresis	3(3)	0(0)	3(3.7)	
	Faint	2(2)	0(0)	2(2.5)	
Disease severity	Mild	24(24)	0(0)	24(29.6)	<0.001
	Moderate	54(54)	4(21.1)	50(61.8)	
	Severe	22(22)	15(78.9)	7(8.6)	
Vital signs, Median(IQR) (Admission time)	Heart rate(bpm*)	89.5(79.25-100)	100(82-100)	88(79-100)	>0.2
	Respiratory rate(bpm**)	19.5(18-20)	19(18-21)	20(18-20)	>0.2
	Temperature(oC)	37(36-37.65)	37.5(37-38)	37(36.5-37.5)	>0.2
	MAP(mm Hg)	93(83-97)	93(83-97)	93(83-97)	0.12
	Peripheral capillary O2 saturation (%)	92(78-96)	78.5(58.7-87)	94(84-97)	0.005
Organ failure	Heart dysfunction	22(22)	3(15.8)	19(23.5)	0.001
	Acute liver injury	4(4)	1(5.2)	3(3.7)	
	Acute kidney injury	3(3)	3(15.8)	0(0)	
	ARDS	4(4)	2(10.5)	2(2.5)	
	Multiple organ failure	2(2)	1(5.3)	1(1.2)	
	Nothing	65(65)	9(47.4)	56(69.1)	
Intubation		9(9)	9(100)	0(0)	-
Clinical outcomes	Improved	81(81)	3(15.8)	78(96.3)	<0.001
	Not improved	19(19)	16(84.2)	3(3.7)	
Days of hospital stay, Median(IQR)		7(5.75-9)	11(5-13)	6(6-8)	0.010

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IQR: Inter-quartile rang; ARDS: acute respiratory distress syndrome; MAP: mean arterial pressure; ICU: Intensive Care Unit. * beat per minute; ** breath per minute.

Table 3. Laboratory tests results of 100 COVID-19 patients admitted to Razi infectious disease referral center, Northern Iran

Variables, Median (IQR)	No.(%)			P
	Total (N=100)	ICU (n=19)	Isolation Ward (n=81)	
WBC (×109 /L; normal range 4-10)	6(5.1-7.7)	7.9(5.9-10)	5.8(4.8-7.2)	0.002
Leukopenia	12(12)	2(10.5)	10(12.3)	>0.2
Neutrophil (normal range 40-60%)	70(59-78)	78(58-87)	68(60-77)	0.164
Increased	61(61)	11(57.9)	50(61.7)	>0.2
Lymphocyte (normal range 20%-40%)	23(13-33)	12(7-28)	24(15-35)	0.005
Lymphopenia	42(42)	12(63.2)	30(37)	0.038
Neutrophil to lymphocyte count ratio (NLR)	3.12(1.90-5.93)	6(1.9-10.5)	2.9(1.9-5.4)	0.047
Monocyte (normal range 2%-8%)	6.4(4.6-9.2)	5.6(4.1-8.7)	6.7(4.7-9.3)	>0.2
Platelet (×109 /L; normal range 150-450)	161(132-203)	168(122-242.5)	160(134-201)	>0.2
Decreased	45(45)	8(42.1)	37(45.7)	0.196
Hemoglobin (g/dL; normal range 12-15)	12.2(11-13.1)	11.4(11-12.1)	12.5(11.2-13.4)	0.011
Decreased	42(42)	14(73.7)	28(34.6)	0.004
Hematocrit (normal range 35%-50%)	35.7(33.8-38.5)	34.3(33-36.5)	36.1(34.1-39)	0.012
Sodium (mmol/L; normal range 135-145)	140(137-143)	144(141-157)	139(136-142)	<0.001
Increased	10(10)	8(42.1)	2(2.5)	<0.001
Decreased	6(6)	1(5.3)	5(6.2)	
Potassium (mmol/L; normal range 3.5-5.5)	4.4(4-4.6)	4.5(3.8-4.7)	4.3(4-4.5)	>0.2
Increased	1(1)	0(0)	1(1.2)	>0.2
Decreased	3(3)	3(15.8)	0(0)	>0.2
Prothrombin time (s; normal range 11-14)	14(13-14.8)	14.4(14.1-15.2)	13.5(13-14.7)	0.045
Increased	41(41)	10(52.6)	31(38.3)	0.011
INR (normal range 0.9-1.5)	1.3(1.1-1.36)	1.34(1.3-1.48)	1.21(1.1-1.33)	0.008
Increased	5(5)	1(5.3)	4(4.9)	>0.2
Alanine aminotransferase (U/L; normal range <34)	29(20-38)	35(18-60)	28(20-35)	>0.2
Increased	21(21)	6(31.6)	15(18.5)	0.103
Aspartate aminotransferase (U/L; normal range 5-40)	35(26-42)	34(23-63)	35(26-40)	>0.2
Increased	23(23)	6(31.6)	17(21)	0.194
Blood urea nitrogen (mg/dL; normal range 13-43)	29(24-40)	47(30-132)	27.5(24-33.8)	<0.001
Increased	19(19)	10(52.6)	9(11.1)	<0.001
Alkaline phosphatase (U/L; normal range 46-306)	138(115-173)	130(108-192)	139(120-173)	>0.2

Variables, Median (IQR)		No.(%)			P
		Total (N=100)	ICU (n=19)	Isolation Ward (n=81)	
Increased		4(4)	1(5.3)	3(3.7)	>0.2
Creatinine (mg/dL; normal range 0.6-1.2)		0.9(0.7-1)	1.1(0.9-1.8)	0.9(0.7-1)	<0.001
Increased		15(15)	8(42.1)	7(8.6)	0.001
Lactate dehydrogenase (U/L; normal range 235-470)		655(510-778)	598(410-1044)	662(523-760)	>0.2
Increased		77(77)	11(57.9)	66(81.5)	>0.2
Creatinine phosphokinase (U/L; normal range <145)		119.5(75-214.5)	111(75-210)	120(75-217.5)	>0.2
Increased		36(36)	5(26.3)	31(38.3)	>0.2
Blood glucose (mg/dL)		112(98-151)	109(95-149)	112(98-161)	>0.2
Erythrocyte sedimentation rate (mm/h; normal range<14)		61(37-75)	68(61-91.5)	59(36-75)	0.048
Increased		86(86)	16(84.2)	70(86.4)	>0.2
C-reactive protein	Positive	67(67)	6(31.6)	61(75.3)	<0.001
	Negative	13(13)	3(15.8)	10(12.3)	
	Not measured	20(20)	10(52.6)	10(12.3)	

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IQR: inter-quartile range; WBC: white blood cells; ICU: intensive care unit; INR: international normalized ratio.

maybe due to insufficient protection for healthcare professionals during the first days of the epidemic in Iran. Less than half of the patients had comorbidity mainly from three known ones, namely, cardiovascular diseases, hypertension, and diabetes mellitus. Most ICU admitted patients were female, belonged to older age groups, and most suffered from comorbidities.

In a similar single-center, retrospective study conducted by Nanshan et al. on 99 proven cases of COVID-19 in a hospital in Wuhan, China, the mean age of the patients was 55, and their age ranged 21-82. Among the patients, 68% were male, and 33% had comorbidities. Cardiovascular diseases and endocrine disorders were the most common concomitant diseases. In contrast to our study, none of the patients were the medical staff [10]. Also, in a cross-sectional study conducted by Chunxia Cao et al. on 135 patients admitted to the only hospital dedicated to treating COVID-19 in Tianjin, China, the mean age of the patients was 49, and 53% were male. Unlike the present study, 10% of the patients were under 20 years of age, and approximately 15% had a positive history of exposure [11]. In a case series study conducted by Moran Ki, introducing the first 28 proven cases of the disease in Korea, it was stated that 54% of the patients were male, and no one was less than 20 years old [12]. Hypertension and diabetes mellitus have also been reported as the most common underlying diseases in other studies [13, 14].

The higher frequency of the disease in men and older age groups was confirmed in other studies [15, 16]. In a large case series study with 274 patients performed by Chen, similar to the present study, the most common underlying diseases were hypertension, diabetes mellitus, and cardiovascular diseases [16, 17].

From the clinical point of view, the most common symptoms in our study were fever, dyspnea, dry cough, and myalgia. Two-thirds of the patients had moderate to severe diseases. Half of them had an oxygen saturation of less than 92% on admission time. Oxygen saturation was more exacerbated among ICU patients with moderate to severe illness in 100% of cases. More than one-third of the patients have undergone organ failure. The median hospital stay time was one week, and half of the ICU admitted patients were hospitalized between 5 and 13 days. The disease mortality rate in this referral center and among the first confirmed cases was 19%.

In a meta-analysis conducted by Pengafi Sun, embracing the results of 10 studies with more than 50000 samples, like our study, the most common clinical symptoms

Table 4. Clinical outcomes analysis of 100 COVID-19 patients admitted to Razi infectious disease referral center, Northern Iran

Variables		Mean±SD/No. (%)			P
		Total (N=100)	Not Improved (n=19)	Improved (n=81)	
Age (y)		56.7±15.6)	65.5±16.7)	52.2±14.4)	0.001
Gender	Male	59(59)	9(47.4)	49(60.5)	>0.2
	Female	41(41)	10(52.6)	32(39.5)	
Comorbidity	Yes	45(45)	13(68.4)	32(39.5)	0.039
	No	55(55)	6(31.6)	49(60.5)	
Disease severity	Mild	24(24)	1(5.3)	23(28.4)	<0.001
	Moderate	54(54)	3(15.8)	51(63)	
	Severe	22(22)	15(78.9)	7(8.6)	
Peripheral capillary O2 saturation (%) in admission time, Median(IQR)		92(78-96)	79(59-87)	94(84-97)	<0.001
Days of hospital stay, Median(IQR)		7(5.75-9)	11(5-15)	7(6-8)	0.092
Lymphopenia		42(42)	12(63.2)	30(37)	0.034
NLR, Median(IQR)		3.1(1.9-5.9)	5.8(1.4-10.4)	2.5(1.2-4.8)	0.092
Sodium (mmol/L; normal range 135-145), Median(IQR)		140(137-143)	144(139-157)	139(137-143)	0.003
Potassium (mmol/L; normal range 3.5-5.5), Median(IQR)		4.4(4-4.6)	4.5(3.9-4.7)	4.3(4-4.5)	>0.2
Prothrombin time (s; normal range 11-14), Median(IQR)		14(13-14.8)	14.3(13.8-15.2)	13.5(13-14.7)	0.158
INR (normal range 0.9-1.5), Median(IQR)		1.3(1.1-1.36)	1.3(1.3-1.47)	1.2(1.1-1.3)	0.017
ESR (mm/h; normal range<14), Median(IQR)		61(37-75)	68.5(59.7-97.2)	59(36.5-75)	0.055
C-reactive protein	Positive	67(67)	8(42.1)	59(72.8)	0.004
	Negative	13(13)	2(10.5)	11(13.6)	
	Not measured	20(20)	9(47.4)	11(13.6)	

PBR

IQR: inter-quartile range; NLR: neutrophil to lymphocyte count ratio; ESR: erythrocyte sedimentation rate; ICU: intensive care unit.

were fever, cough, and myalgia, and approximately 81% of the patients suffered from severe disease [18]. According to Zunyou Wu's report from the Chinese Centre for Disease Control and Prevention, the disease was severe in 19% of the cases [13]. Also, fever and cough were the most common clinical complaints in Guan W et al.'s study, based on medical records data from 1099 patients [15]. In contrast to our research, in their study, more than 16% of the patients were admitted to ICU, and the average hospital stay was 12 days which was more than what was found in our study. In a Cohort study that tracked the clinical outcomes of 191 COVID-19 patients, Zhou et al. reported that 54 cases (28%) died [12]. In this study, the median time from illness onset to admission in the hospital was 11 days which was longer than what was shown in our study. In addition, 48% of the patients suffered from underlying diseases. Therefore, perhaps for these two reasons, the mortality rate reported in this study was higher than that of our study (28% vs 19%). In most cross-sectional studies10, 11, it is impossible to measure the frequency of final clinical outcomes during the study period, so the death rate reported in these studies was not conclusive and comparable to the present study.

The main laboratory findings of patients with COVID-19 in our research were as follows:

Table 5. Therapeutic regimen of 100 COVID-19 patients admitted to Razi infectious disease referral center, Northern Iran

Type of Drugs	Drug Regimen	No.(%)	Others
Antivirals (n=100)	HCQ+oseltamivir	35(35)	
	HCQ+oseltamivir+Kaletra	24(24)	
	HCQ+Kaletra	10(10)	Ivlg (1), VitD3 (1)
	HCQ	7(7)	
	HCQ+Kaletra+ribavirin	5(5)	
	Oseltamivir+Kaletra	4(4)	
	HCQ+ribavirin+oseltamivir+Kaletra	3(3)	
	Oseltamivir+ribavirin+Kaletra	3(3)	Ivlg (1)
	Ribavirin+Kaletra	2(2)	
	Oseltamivir	2(2)	
	Kaletra	2(2)	Ivlg (1)
	HCQ+oseltamivir+ribavirin	1(1)	
	HCQ+Sovodac	1(1)	Ivlg (1)
	HCQ+Sovodac+oseltamivir+Kaletra	1(1)	
Antibiotics (n=95)	Ceftriaxone	46(48.4)	
	Levofloxacin	31(32.6)	
	Azithromycin	24(25.2)	
	Imipenem	23(24.2)	
	Vancomycin	19(20)	
	Teicoplanin	16(16.5)	
	Tazocin	15(15.8)	
	Meropenem	12(12.6)	
	Clindamycin	6(6.3)	

HCQ: hydroxychloroquine. Kaletra: Lopinavir+Ritonavir; Sovodac: Sofosbuvir+Daclatasvir.

PBR

lymphopenia, decreased Hb level and prolonged PT/INR in more than 40% of patients, elevated NLR and increased hepatic aminotransferases in more than 20% of the cases, and finally, increased LDH in more than three-quarters of the patients.

All profiles mentioned above, except for LDH, in addition to renal function tests, were more severe among patients with critical conditions admitted to ICU.

The laboratory findings have been confirmed in almost all other relevant studies. For example, in Nanshan's study, lymphopenia was reported in 35% of the cases, decreased hemoglobin in 50% of the cases, increased hepatic aminotransferases in one-third of patients, and increased serum LDH in three-quarters of the cases, which are almost identical to the present study results. However, long PT was reported in only 5% of the cases; this finding is inconsistent with our study [10]. Lymphopenia in other studies has been reported with a frequency from 40% to more than 80% of the cases [14-17]. In contrast to the present study, an increase in serum LDH levels was reported in other studies from a quarter to more than 40%

of the patients [16, 17]. One of the findings of our study was the calculation of NLR, which was not calculated as an independent indicator in any other research.

The non-survivor cases in the current research were from older age groups with a high frequency of underlying comorbidities and severe illnesses. Also, lower peripheral capillary O2 saturation on admission time and higher frequency of lymphopenia were two main laboratory findings in non-survivor cases.

Most of the findings of the non-survivor cases in the present study have been confirmed in other studies. For example, the higher frequency of lymphopenia and prolonged PT among deceased cases in Zhou's study [12], lower levels of oxygen saturation and lower lymphocyte count, as well as longer PT and higher ESR in non-survivor cases in Chen's study [16] and lower lymphocyte count, prolonged PT as well as older age and greater frequency of comorbidities in the non-survivor ones have been confirmed in Sun's study [18]. Since, in the present study, there was no significant difference between mild and severe cases of the disease in terms of serum LDH levels, we did not compare this index between those who survived and those who died. However, other studies have emphasized an increase in LDH among the non-survivor cases [15, 17, 18].

Finally, due to the lack of effective treatment for the disease, various antivirals, and antibacterial protocols have been used in various studies. For example, in Nanshan Chen's study, the most common antivirals were oseltamivir, ganciclovir, and lopinavir [10]. Also, cephalosporins and quinolones were commonly used in this study. In Guan's study, antivirals were used only for 21% of the patients compared to antibacterial agents, which were used for almost 95% of the cases [15]. Similarly, in Xu's study, antiviral and antibacterial drugs were used for 44% and 94% of patients, respectively; also, multiple antivirals were used for 89% of the cases in Xu's study [13].

In conclusion, according to most studies published so far, COVID-19 is mostly a disease of older age groups, with a male to female ratio of more than 1, and is more likely to have adverse outcomes in people with underlying diseases. Lymphopenia, increased NLR, anemia, prolonged PT and INR, increased serum level of LDH, disturbed hepatic aminotransferase level, and some electrolyte disturbances are profiles and indices commonly seen in COVID-19 patients' laboratory dashboard. Almost all profiles mentioned above are more exacerbated among cases with more severe and critical conditions and the deceased cases. So all the variables discussed above can be used in developing clinical guidelines that can predict the final clinical outcomes.

One of the most important strengths of this study was the re-reading of patients' medical records two weeks after the final patient's hospitalization to more accurately estimate the final clinical outcome measures. It was also possible to calculate the NLR index and compare it between the subgroups studied, as the most important strength of the present study. Since this study was conducted in the early days of the epidemic, it accurately shows the readiness of the healthcare service in the face of a new biological disaster.

The main weaknesses of the present study include the lack of requests for some laboratory tests, such as CRP for some patients.

Ethical Considerations

Compliance with ethical guidelines

The participants were informed of the purpose of the research and its implementation stages. A written consent has been obtained from the subjects. They were also assured about the confidentiality of their information and were free to leave the study whenever they wished, and if desired, the research results would be available to them. The Helsinki Convention was also observed.

Funding

This research was funded by the Vice-Chancellor for Research of Mazandaran University of Medical Sciences. The Ethical Committee University of Medical Sciences approved the study (Code: IR.MAZUMS, REC.1398.1436).

Authors' contributions

Conceptualization and supervision: Hamideh Abbaspour Kasgari and Farhang Babamahmoodi; Investigation, Writing - original draft, and Writing - review & editing: All authors; Data analysis: Siavash Moradi, Amir Mohammad Shabani1, Farhang Babamahmoodi, Lotfollah Davoodi, and Alireza Davoudi Badabi.

Conflict of interest

All authors declared no conflict of interest.

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