



Clinical Characteristics of the Patients Who Were Infected with Novel Coronavirus in Guilan, Iran, during 2019: A Cross-sectional Study

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Abstract

Background: Coronavirus disease 2019 (COVID-19) has been introduced by the World Health Organization as a pandemic and emergency for human health.

Objectives: This study aimed to investigate the clinical characteristics of patients infected with COVID-19 in Guilan Province, Iran.

Methods: This retrospective study was conducted on 1,000 patients with a definitive diagnosis of COVID-19 pneumonia admitted to six hospitals in Guilan Province, Iran, from April 13 to June 14, 2020. This study evaluated the patients' clinical information, demographic characteristics, laboratory results, and chest computed tomography scans.

Results: The mean age of the patients was obtained at 55±1.3 years, and the majority (n=800; 80%) of the cases were male. Furthermore, most patients had underlying diseases, including respiratory system disease (n=173; 17.3%), cardiovascular disease (n=711; 71.1%), and malignancy (n=146; 14.6%). Some of the most common causes of infection with coronavirus were being in crowded places (n=733; 73.3%), close contact with an infected person (n=370; 82.2%), possession of pets (n=107; 23.2%), and family gatherings (n=822; 82.2%). In addition, the most common clinical symptoms in patients included fever (n=911; 91.1%), cough (n=900; 90%), and dyspnea or shortness of breath (n=889; 88.9%). Other less common symptoms were diarrhea (n=160; 16%), vomiting (n=168; 16.8%), and headache (n=217; 21.7%). Dyspnea was developed in 889 patients (88.9%), and 660 (66%) cases had increased leucocytes.

Conclusion: Coronavirus would cause mild to fatal pneumonia in patients. Therefore, early detection and treatment is of significant importance for these patients. Timely treatment of this disease could reduce the severity of the symptoms and prevent further spread of the disease.

Keywords: Acute respiratory disease, COVID-19, Novel coronavirus 2019, Pneumonia

1. Background

The widespread outbreak of Coronavirus disease 2019 (COVID-19) and the announcement of a pandemic by the World Health Organization (WHO) are warnings to various countries and an emergency for human health (1,2). In December 2019, in Wuhan, Hubei Province, China, a large number of people were diagnosed with pneumonia and acute respiratory syndrome, the manifestations of which were a viral factor in the onset of these symptoms. Analysis of samples taken from the lower part of the lungs of the patients with this disease showed a novel type of coronavirus which caused COVID-19 (3-5). Coronaviruses are a class of RNA viruses with an outer cover that belongs to the Coronaviridae family and are widely found in humans and mammals (6).

It is currently known that two pathogens of the virus, which have led to an epidemic of two types of beta-coronaviruses, including Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and Middle East Respiratory Syndrome (MERS-CoV), have affected more than 10,000 people in two decades

(7-9). The virus is one of the main pathogens of infection in the human lungs. The extent of the virus transmission is unknown; however, available evidence suggests human-to-human transmission (10,11). COVID-19 appears to have different characteristics, compared to SARS-CoV and MERS-CoV. Moreover, it multiplies in the upper gastrointestinal tract and does not cause sudden clinical manifestations in comparison with the coronavirus that causes common colds (12).

Individuals infected with novel coronavirus are initially asymptomatic that might lead to the transmission of the infection to other healthy individuals. However, in SARS-CoV, the disease could not be transmitted through carriers, leading to easier control of the disease (13,14). Most patients with COVID-19 would express mild symptoms. Other patients would develop symptoms, such as shortness of breath and fever after one to two weeks of illness; moreover, patients with severe conditions would quickly develop the acute respiratory syndrome, organ failure, coagulopathy, septic shock, and metabolic acidosis (15-17). Based on the available

statistics, it has been found so far that most of the patients with COVID-19 had mild symptoms and a good prognosis, and few patients had severe symptoms. Studies have shown that factors, such as fever, dyspnea, number of breaths, number of white blood cells, neutrophils, albumin, procalcitonin, number of lymphocytes, and D-Dimer are the most important determinants of the disease (18,19).

Iran is one of the countries that has been affected by the epidemic of this disease. Meanwhile, Guilan province is one of the main centers of this disease in Iran. Very few studies have been conducted on clinical characteristics of the patients with COVID-19 in the world, and no study has been conducted in this regard in Guilan province. Familiarity with clinical features and laboratory findings in patients infected with COVID-19 in different contexts can help a lot in controlling and identifying treatment methods. Accordingly, it is necessary to perform more research in this area. Given the importance of managing and controlling the patients with COVID-19 and the need to publish evidence in this field, this study aimed to investigate the clinical characteristics of the patients infected with COVID-19 in Guilan province, Iran.

2. Objectives

The human coronavirus infections that have emerged over the past two decades include SARS-CoV and MERS-Co. Familiarity with the clinical features of the patients with COVID-19 is very important for early detection and faster management. During the COVID-19 pandemic, WHO has declared an emergency for human health. Novel coronavirus would cause mild to fatal pneumonia in the patients, which might lead to death. Therefore, early detection and treatment of these patients is of significant importance. Timely treatment of the disease could reduce the severity of the symptoms and prevent further spread of the disease. Accordingly, this study aimed to investigate the clinical characteristics of the patients infected with novel coronavirus in Guilan province, Iran.

3. Methods

This multicenter cross-sectional study was conducted in six hospitals that were the centers for the treatment of coronavirus in Guilan province. Guilan is one of the main provinces involved with COVID-19 in Iran from April 13 to June 14, 2020. The inclusion criteria were confirmed diagnosis of COVID-19 and admission to one of the six hospitals that were the centers for the treatment of coronavirus in Guilan Province, Iran. Diagnosis of patients with COVID-19 was according to the WHO interim guidance (20). The positive diagnosis of COVID-19 was confirmed through a positive nasopharyngeal culture sample for COVID-19 using

the Real-Time (RT) PCR test. On the other hand, the patients with a history of chemotherapy or immunodeficiency diseases or those who consumed medications, such as chloroquine or hydroxychloroquine were excluded from the study.

In the present study, medical records were used to collect the clinical symptoms, laboratory findings, imaging results, disease complications, and patient outcomes. The required information was collected from the medical records of six tertiary corona hospitals in Guilan province from April 13 to June 14, 2020. Patients who were infected with novel coronavirus were confirmed using RT-PCR method. Regarding the assessment of the medical records, if there was any ambiguity, the attending physicians were asked to find the necessary information. All data were obtained, carefully reviewed, and interpreted by the two main physicians in this study (TY and HB). All patients had at least one chest computed tomography (CT) scan or chest x-ray. All complications that might be resulted from COVID-19 were also considered in this study.

This study investigated demographic characteristics, clinical manifestations, laboratory results, radiological findings, patient outcome, presence of comorbidities, disease complications, and treatments. The obtained data were analyzed in SPSS software (version 21) through descriptive statistics (mean±SD) (if data had normal distribution), as well as median, interquartile range (if data did not have normality), and frequency.

4. Results

This study included 1000 patients with COVID-19. The common causes of the infection with coronavirus included the presence in crowded places (n=733; 73%), close contact with infected individuals (n=822; 82.2%), possession of pets (n=232; 23.2%), and family gatherings (n=190; 19%). It should be mentioned that none of the patients were from the medical staff. The mean age of the patients was obtained at 55±1.3 years, and the majority of them (n=800; 80%) were male. Moreover, most patients had a history of chronic diseases, including respiratory, cardiovascular, cerebrovascular, endocrine system, and digestive system diseases, as well as malignancy (Table 1). Furthermore, the most common clinical symptoms in the patients included fever (n=911; 91.1%), cough (n=900; 90%), and dyspnea or shortness of breath (n=889; 88.9%). Other symptoms were myalgia or arthralgia, chest pain, anosmia, headache or dizziness, confusion, sore throat, rhinorrhea, nausea and vomiting, diarrhea, and expectoration (Table 2). A lot of patients had comorbid conditions and multiple organ failure, including septic shock, acute respiratory distress syndrome (ARDS), acute renal injury, acute cardiac injury, and ventilator-associated pneumonia (Table 2).

Table 1. Demographic and baseline characteristics of the patients who were infected with novel coronavirus

	Patients (n=1000)
Age (year)	
Mean (SD)	55 (1.3)
Range	20-84
≤39	65 (6.5%)
40-49	133 (13.3%)
50-59	550 (55.5%)
60-69	122 (12.2%)
≥70	124 (12.4%)
Gender	
Male	800 (80%)
Female	200 (20%)
Occupational status	
Employee	66 (6.6%)
Self-employed	845 (84.5%)
House wife/husband	51 (5.1%)
Agriculture worker	15 (1.5%)
Retired	22 (2.2%)
Cause of infection	
Close contact	822 (82.2%)
Presence in crowded places	733 (73.3%)
Possession of pets	232 (23.2%)
Family gatherings	190 (19%)
Chronic medical history	
Respiratory system diseases	173 (17.3%)
Cardiovascular and cerebrovascular diseases	711 (71.1%)
diseases	
Malignancy	146 (14.6%)
Endocrine system diseases	26 (2.6%)
Nervous system diseases	122 (12.2%)
Digestive system diseases	
Clinical outcome	
Discharged	829 (82.9%)
Died	171 (17.1%)
Disease Severity	
Mild	100 (10%)
Moderate	330 (33%)
Severe	570 (57%)

According to the severity of the disease, most of the patients (n=570; 57%) had severe conditions, and 33% of them had moderate conditions (n=330) (Table 2).

Based on lung CT scan findings, bilateral chest involvement was observed in 872 patients (87.2%), while unilateral chest involvement was noted only in 85 patients (8.5%). Furthermore, ground-glass opacity (GGO), crazy paving opacity, consolidation, and centrilobular nodules were observed in 618 (61.8%), 576 (57.6%), 40 (4%), and 16 (1.6%) patients, respectively (Table 2). Regarding the treatment, most patients received antibiotics (91.1%), and other treatment procedures included the administration of antiviral medications (n=840; 84%), antifungals (n=271; 27.1%), and corticosteroids (n=196; 19.6%) (Table 2).

Upon admission, leukocytes were lower than normal in 50 patients (5%) and higher than normal in 660 patients (66%). Furthermore, 380 (38%) patients had more neutrophils than the normal range. Lymphocytes and hemoglobin were also reported to be below the normal range in many of the patients (36% and 55%, respectively). Platelets were lower than the normal range in 130 (13%) patients and

Table 2. Clinical presentation and treatment of the patients who were infected with novel coronavirus

	Patients (n=450)
Signs and symptoms upon admission	
Fever	911 (91.1%)
Cough	900 (90%)
Dyspnea or shortness of breath	889 (88.9%)
Myalgia or arthralgia	400 (40%)
Chest pain	377 (37.7%)
Anosmia	200 (20%)
Headache or dizziness	217 (21.7%)
Confusion	202 (20.2%)
Sore throat	189 (19.8%)
Rhinorrhea	182 (18.2%)
Nausea and vomiting	168 (16.8%)
Diarrhea	160 (16%)
Expectoration	467 (46.7%)
More than one sign or symptom	978 (97.8%)
Comorbidity	
Septic shock	171 (17.1%)
Acute respiratory distress syndrome	713 (71.3%)
Acute renal injury	271 (27.1%)
Acute cardiac injury	173 (17.3%)
Ventilator-associated pneumonia	51 (5.1%)
Chest x-ray and CT results	
Unilateral chest involvement	85 (8.5%)
Bilateral chest involvement	872 (87.2%)
Ground-glass opacity	618 (61.8%)
Crazy paving opacity	576 (57.6%)
Consolidation	40 (4%)
Centrilobular nodules	16 (1.6%)
Treatment	
Antibiotic treatment	911 (91.1%)
Antiviral treatment	840 (84%)
Antifungal treatment	271 (27.1%)
Glucocorticoids	196 (19.6%)
Inhalers	467 (46.7%)
Intravenous immunoglobulin therapy	174 (17.4%)
Oxygen therapy	978 (97.8%)
Mechanical ventilation	356 (35.6%)

more than the normal range in 50 (5%) patients. Degrees of liver dysfunction were also observed as increased alanine aminotransferase (ALT) or aspartate aminotransferase (AST). Most of the patients had abnormal cardiac findings; accordingly, creatine kinase and lactate dehydrogenase increased in 150 (15%) and 760 (76%) patients. There were also some degrees of renal impairment with increased blood urea nitrogen in 180 (44%) patients or serum creatinine in 40 (4%) patients. Procalcitonin levels in 60 (6%) patients and C-reactive protein in 890 (89%) patients were reported to be higher than the normal range (Table 3).

5. Discussion

The present study investigated the clinical characteristics, laboratory and imaging findings of 1,000 admitted patients who were infected with coronavirus from referral hospitals in the cities of Guilan province. In general, human coronavirus is one of the most important pathogens that could cause respiratory infections in humans. The two most common pathogens of the coronavirus, including

Table 3. Laboratory findings of the patients who were infected with novel coronavirus

Blood routine	
Leucocytes ($\times 10^9$ per L; normal range 3.5-9.5)	7.8 (3.7)
Increased	660 (66%)
Decreased	50 (5%)
Neutrophils ($\times 10^9$ per L; normal range 1.8-6.3)	6.0 (3.3-8.1)
Increased	380 (38%)
Lymphocytes ($\times 10^9$ per L; normal range 1.1-3.2)	0.8 (0.5)
Decreased	360 (36%)
Platelets ($\times 10^9$ per L; normal range 125.0-350.0)	213.5 (79.1)
Increased	50 (5%)
Decreased	130 (13%)
Haemoglobin (g/L; normal range 130.0-175.0)	128.8 (13.8)
Decreased	550 (55%)
Coagulation function	
Activated partial thromboplastin time (s; normal range 21.0-37.0)	26.3 (11.2)
Increased	50 (5%)
Decreased	170 (17%)
Prothrombin time (s; normal range 10.5-13.5)	11.2 (1.9)
Increased	60 (6%)
Decreased	400 (40%)
D-dimer ($\mu\text{g/L}$; normal range 0.0-1.5)	0.8 (0.5-2.8)
Increased	460 (46%)
Blood biochemistry	
Albumin (g/L; normal range 40.0-55.0)	32.6 (3.0)
Decreased	980 (98%)
Alanine aminotransferase (U/L; normal range 9.0-50.0)	38.0 (23.0-53.0)
Increased	380 (38%)
Aspartate aminotransferase (U/L; normal range 15.0-40.0)	33.0 (26.0-48.0)
Increased	360 (36%)
Total bilirubin ($\mu\text{mol/L}$; normal range 0.0-21.0)	14.1 (7.3)
Increased	177 (17.7%)
Blood urea nitrogen (mmol/L; normal range 3.6-9.5)	5.7 (2.6)
Increased	70 (7%)
Decreased	180 (18%)
Serum creatinine ($\mu\text{mol/L}$; normal range 57.0-111.0)	74.6 (24.0)
Increased	40 (4%)
Decreased	200 (20%)
Creatine kinase (U/L; normal range 50.0-310.0)	84.0 (50.0-184.0)
Increased	150 (15%)
Decreased	240 (24%)
Lactate dehydrogenase (U/L; normal range 120.0-250.0)	346.0 (260.0-447.0)
Increased	760 (76%)
Glucose (mmol/L; normal range 3.9-6.1)	7.3 (3.4)
Increased	520 (52%)
Decreased	10 (1%)
Infection-related biomarkers	
Procalcitonin (ng/mL; normal range 0.0-5.0)	0.4 (1.1)
Increased	60 (6%)
Erythrocyte sedimentation rate (mm/h; normal range 0.0-15.0)	48.9 (24.3)
Increased	800 (80%)
C-reactive protein (mg/L; normal range 0.0-5.0)	51.4 (42.8)
Increased	890 (89%)

SARS-CoV and MERS-CoV, could cause severe respiratory infections in humans, and four other classes of coronaviruses (HCoV-OC43, HCoV-229E, HCoV-NL63, HCoV-HKU1) could cause mild infections in the human respiratory system. The outbreak of SARS-CoV in 2002-2003 affected 8,422 people and 29 countries worldwide (21,22). The MERS-CoV also spread to the Middle Eastern countries in 2012. The prevalence of COVID-19 is different from that of the other six coronaviruses and classified as beta-coronaviruses (23).

According to the present study, a decrease in lymphocytes and an increase in neutrophils were found in 360 (36%) and 380 (38%) patients, respectively. Lymphocyte depletion has also been

reported in similar studies (24,25); however, in some studies, lymphocyte depletion of up to 85% has been reported in critically-ill patients infected with coronavirus (26). One reason for the decrease in lymphocytes is that COVID-19, the same as SARS-CoV, affects T lymphocytes. In fact, the spread of viral particles through the respiratory mucosa leads to the infection of other cells, causing a cytokine storm in the body that triggers several immune responses in the body, leading to changes in white blood cells and immune cells, such as lymphocytes (6). Some studies have also suggested that a significant decrease in lymphocytes might be due to the fact that the coronavirus consumes immune cells and prevents the immune system from functioning

properly (27). However, in some studies, the decrease in lymphocytes was not significant in the mild severity of the disease (9,24,25). One of the reasons for this could be the difference in the severity of the disease. Evidence suggests that lymphocyte decrease is more common in patients with moderate to severe infection of coronavirus, compared to patients with mild infection. In fact, damage to T lymphocytes could be an important factor in the severity of the disease (27). According to a study conducted by Xu et al., lymphocyte depletion was reported in 38% of the patients with clinical signs of COVID-19 in less than 10 days (28). Therefore, it could be assumed that lymphocyte depletion is an indicator of the severity of COVID-19 rather than a diagnostic criterion. According to the present results, thrombocytopenia, as well as liver and renal dysfunction were significant findings in infected patients. Studies have shown that platelet count could discriminate between severe and non-severe COVID-19. Patients who did not survive had a significantly lower platelet count, compared to the survivors (18). Thrombocytopenia is associated with increased risk of severe disease. A substantial decrease in the platelet count might be an indicator of worsening of the illness. Moreover, elevated baseline blood urea nitrogen and serum creatinine are independent risk factors for hospital mortality (29). Therefore, more attention should be paid to COVID-19 patients who had elevated baseline blood urea nitrogen and serum creatinine. In the present study, degrees of liver dysfunction were also observed as ALT or AST. Therefore, in patients with a history of liver diseases (especially older patients), special attention should be paid to monitoring hepatic changes caused by COVID-19 while carefully identifying the cause of the liver dysfunction. It is recommended that front-line medical staff should assess the use of appropriate hepatoprotective therapies, especially in patients with pre-existing liver diseases, in order to attenuate the potentially deleterious impact of COVID-19-related liver damage/dysfunction (30).

In the present study, the condition of many patients was developed to ARDS and septic shock rapidly, which eventually led to failure of multiple organs. Therefore, prompt identification and rapid treatment of the patients with serious conditions should be one of the main goals in the management of these patients. The use of intravenous immunoglobulin, which acts as an anti-infection, and steroids (methylprednisolone 1-2 mg / kg per day) is recommended for critically-ill patients and those with ARDS to shorten the course of treatment, respectively (6).

In this study, many similarities have been observed between the clinical features of the patients with COVID-19 and the other outbreaks of coronavirus infections. Furthermore, most patients

had a fever, cough, dyspnea, and bilateral GGO on lung CT scan. These clinical signs are similar to the symptoms caused by SARS-CoV and MERS-CoV (31,32). In general, unlike types of pneumonias caused by other pathogens, COVID-19 had unique features on lung CT scans. Among other things, multi-lobe involvement was a unique feature in COVID-19, compared to other types of pneumonias. In addition, GGO, mixed GGO, and consolidation were more common in the peripheral area of the lungs in patients with mild infection; however, in patients with severe infection, GGO was scattered throughout the lung. Based on a study performed by Pan et al., it was found that 11.1% and 44.4% of the patients had involvement of four and five pulmonary lobes, respectively; moreover, GGO and patchy consolidation were common findings in their lung CT scans (33). It is worth mentioning that similar findings were reported in another study (34).

However, according to the present study, a small number of the patients had symptoms of upper respiratory tract infection, such as rhinorrhea, sneezing, or sore throat, which may show that novel coronavirus target cells are in the lower respiratory tract. Additionally, in the present study, a small number of the patients developed gastrointestinal symptoms, while about 20%-25% of the patients with MERS-CoV or SARS-CoV developed gastrointestinal symptoms, such as diarrhea or vomiting (30). In this regard, it is necessary to conduct more extensive research on urine and fecal samples of patients with COVID-19 in order to identify other ways for transmission of the disease (24).

Limitations

One of the limitations of the present study was no access to some of the patients' medical records due to the lack of an electronic registration system for patients' medical records. Moreover, some of the data were missing. In order to reduce the effect of this limitation, patients whose medical information was incomplete were excluded from the study.

Implication for clinical setting

COVID-19 is an emerging disease, the pandemic of which has affected the entire world. Familiarity with clinical features and laboratory findings of the infected patients could help a lot in controlling and identifying the treatment methods.

Suggestion for future studies

Due to the difficulty in collecting information from the patients' records and the risk of infection with novel coronavirus for the researchers, it is recommended that hospitals use appropriate forms to record the patients' information so that the researchers could easily access patient's information for future studies.

6. Conclusion

Based on the present study, it was found that most of the patients with COVID-19 had a severe degree of infection and a decrease in lymphocytes was reported in 36% of them, which suggests that a decrease in lymphocytes could be one of the criteria for diagnosing the severity of the disease. In addition, changes in neutrophil and White Blood Count cell counts are of clinical significance for the differential diagnosis of COVID-19-induced pneumonia from other types of pneumonias. Findings from the lung CT scans of the patients with COVID-19 also had typical characteristics, such as the number of involved lobes, and the pattern of the lesion as well as their dispersion, which could help physicians to differentiate COVID-19-induced pneumonia from other pneumonias.

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Footnotes

Conflict of Interests: The authors have no conflict of interest to declare.

Ethical Approval: This study has been approved by the Ethics Committee of Guilan University of Medical Sciences, Rasht, Iran (IRB approval: IR.GUMS.REC.1398.541). All the private information that was obtained from the patients' records was kept confidential.

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