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Clinical and Laboratory Findings of Influenza Patients: A Retrospective Study from 2013 to 2018

Abstract

Influenza, a highly contagious virus, can affect both human and animal populations, leading to pandemics that can occur at any time of the year. This study aimed to investigate the epidemiological, clinical, and paraclinical characteristics of influenza patients admitted to Tehran's Besat Hospital between 2013 and 2018. The research, conducted as a cross-sectional survey, included data from all hospitalized influenza patients during the specified period. The statistical population comprised 80 patients, with a nearly equal distribution between males (48.1%) and females (51.9%). A significant portion of patients (43.6%) were aged over 60.

Symptoms among the patients included fever exceeding 38 °C (81.3%), cough (77.5%), fatigue (58.8%), myalgia (57.5%), shortness of breath (48.8%), headache (43.8%), and chest pain (38.8%). CT scans of patients' lungs revealed various findings, such as no lesions (38.8%), ground-glass lesions (28.7%), consolidation lesions (12.9%), and combined consolidation and ground-glass lesions (20%). Laboratory results indicated prevalent leukopenia (40%), lymphopenia (62.5%), anemia (40%), thrombocytopenia (47.5%), and elevated inflammatory markers like ESR, CRP, LDH, and ALP (40%).

Overall, this study found similar influenza prevalence among men and women. The majority of patients were older individuals, predominantly retired workers and housekeepers with a high school education or higher. Common clinical symptoms included fever, cough, and body pain, while laboratory findings primarily impacted white blood cell counts and various inflammatory markers. Understanding these epidemiological and clinical aspects is essential for effective influenza management and prevention.

Keywords: *influenza, inflammatory markers, clinical manifestations, laboratory findings, C-reactive protein, epidemiology*

Haleh Massoudi[1], Soheila Abolghasemi[2] Nader Taghavi[3], Mohammad Darvishi[4*]

[1]Researcher & General Practitioner, Medical Branch, Islamic Azad University of Tehran, Tehran, Iran

[2] Medical Branch, Islamic Azad University of Tehran, Tehran, Iran

[3] School of Aerospace And Subaquatic Medicine, Aja University of Medical Sciences, Tehran, Iran

[4] Infectious Diseases and Tropical Medicine Research Center(IDTMC), School of Aerospace And Subaquatic Medicine, Aja University of Medical Sciences, Tehran, Iran, Corresponding Author Email: darvishi1349@gmail.com

Introduction

An acute respiratory disease that is contagious and results in yearly epidemics of varying severity is influenza. It is deemed necessary to study infectious diseases regionally and pay attention to the clinical course and laboratory symptoms of each infectious diseases due to the influence of regional factors, genetics, immune history, and background diseases on the incidence and severity of the disease (1).

Following the Coronavirus pandemic, a report from June 20, 2021, states that the number of influenza cases worldwide has significantly decreased and that the Coronavirus is the focus of everyone's attention. There have been seasonal flu cases reported in both the northern and southern hemispheres, and in some places, like China, the number is gradually rising. 146,816 tests were performed between June 7th and June 21st, 2021, according to data from the National Influenza Centers (NICs), of which 766 tests were positive for influenza. A total of 84 (11%) type A tests and 682 (89%) type B tests were reported. There were 45 (85.7%) H1N1 and 8 (14.3%) H3N2 diagnostic samples of type A as well. The World Health Organization urged nations to use the simultaneous diagnostic kit for COVID-19 and influenza to make a diagnosis and ensure that flu treatment was administered (2).

Evaluations of previous influenza pandemics indicate that the behavior of many influenza viruses is unpredictable. Consequently, the epidemiological pattern of the disease may vary from country to country and even within the same country during different waves of pandemic (3).

In the study conducted by Nabavi et al. (2018), 50.5% of the patients admitted to hospitals affiliated with the Shahid Beheshti University of Medical Sciences in 2015 were female, while 49.5% were male. The majority of patients (35.9%) were over 65 years old, and cough, fever above 38 °C, and shortness of breath were the most common symptoms. Also, 10 out of 16 deceased patients had a single underlying condition, while 6 patients had two, heart and lung diseases (4).

Research reveals that the flu virus can spread in aerosol droplets that are formed during normal breathing. Human H1N1 influenza virus symptoms include fever, coughing, sore throat, body aches, headaches, flushing of the cheeks, and appetite loss. However, in 2009, diarrhea and vomiting were also reported as symptoms of this disease. The death brought on by this virus is more frequently seen in people with underlying conditions and illnesses like heart disease, lung disease, diabetes, and immune system deficiencies. When this virus is linked to secondary complications like secondary bacterial pneumonia, especially with group A streptococci and

staphylococci, the severity of influenza disease and its associated mortality increase (5).

Although the cough may last for several weeks, the acute illness associated with uncomplicated influenza typically gets better within 2–5 days. Patients over 65 and children under 5 who have certain chronic diseases like heart disease, lung disease, diabetes, hemoglobinopathy, kidney dysfunction, and immune deficiency are particularly susceptible to developing influenza symptoms. The second and third trimesters of pregnancy also increase a person's susceptibility to influenza symptoms (6). Both pulmonary and extrapulmonary symptoms are among the disease's symptoms. The primary viral pneumonia caused by influenza, which is the least frequent and most serious type, is the most significant lung condition. Extrapulmonary symptoms include myositis, rhabdomyolysis, myocarditis, pericarditis, CNS symptoms, and occasionally hematological manifestations such as anemia, leukopenia, lymphopenia, neutropenia, and thrombocytopenia. These conditions can cause kidney failure in some patients. Leukopenia and thrombocytopenia are relatively common symptoms of this disease, and they have a direct correlation with patient mortality (7).

Influenza causes distinct laboratory manifestations in individuals of varying ages, gender, and underlying disease status. Significant numbers of people have anemia and thrombocytopenia, but there is no correlation between these conditions and the age of the patients (8). Thrombocytopenia and leukopenia, particularly lymphopenia, are observed in influenza patients with an underlying disease and a more severe condition, which is directly linked to patient mortality. The most significant finding in routine hematological tests for patients with new virus types, such as H1N1, H5N1, and H7N, has been designated as thrombocytopenia. Leukopenia and lymphopenia were mentioned as additional observations. In general, one can anticipate an increase in the serum level of CRP in these patients, but according to studies, this factor is significantly higher in intensive care unit patients (9). Procalcitonin is another factor that rises in response to this disease, but both CRP and procalcitonin rise less in influenza than in bacterial infections (10).

A significant portion of patients with confirmed flu had lung CT scans early in the illness that revealed no lesions, according to radiological studies of lung CT scans. The most frequent abnormal finding is consolidation, which is then followed by lung interstitial tissue involvement and ground glass opacity lesions. Consolidation and ground glass opacity lesions are frequently found together, and the patchy form is more frequently reported than the diffuse form. Rare lesions included nodules, adenopathy, and effusion, and bilateral lung involvement was more typical than unilateral. The lower regions of the lung are more likely to be affected than the other regions, and in the middle regions, widespread involvement, followed by peripheral involvement, and finally, a rare central form around the lung, have all been reported (11).

The ability to manage the disease and lessen its complications will depend on being aware of how widespread this illness is in both humans and animals. Influenza has a significant impact on society and the economy in addition to health. Due to the coronavirus pandemic, a lot of time and effort has been devoted in the past 18 months to the diagnosis and treatment of the coronavirus disease, even though the World Health Organization reports that the flu has not yet been completely eradicated and is still spreading globally, albeit more slowly than before.

Since regional factors, genetics, and immune history all have an impact on disease incidence and severity, every infectious disease necessitates a regional statistical study. Furthermore, because the death rate from influenza varies in frequency and severity across age, gender, occupational, and geographical groups, and even in some groups with underlying diseases, conducting a second study using a structured review method and meta-analysis provides a suitable assessment of clinical manifestations and paraclinical findings, and an examination of age, gender, occupation, and background is extremely important. The purpose of this study was to determine the epidemiological, clinical, and paraclinical characteristics of patients with influenza admitted to Tehran's Besat Hospital.

Material and method

This study was cross-sectional. All patients referred to Tehran's Besat Hospital between 2013 and the end of the summer of 2018 who had influenza confirmed by polymerase chain reaction (PCR) and clinical or epidemiological evidence comprised the statistical population of this study. In this regard, all hospitalized patients with the mentioned conditions were included in the sample size, which was established using the total population sampling method.

The following were listed among the exclusion standards:

- Lacking a complete archive file;
- Suffering from an underlying leukemia condition;
- Taking medications with bone marrow suppression as a side effect;
- Having an organ transplant history;
- Having a lupus history.

The data of 80 patients who were hospitalized for at least 24 hours in different hospital wards such as the infectious, special care, cardiac, and internal special care departments were taken into account. The researcher used some checklists to record the required data after consulting the medical records archive of Besat Hospital. The collected data were analyzed using SPSS 22, and mean and standard deviation scores for quantitative variables and absolute and relative frequency for qualitative variables were obtained.

Results

Table 1. Gender frequency distribution.

Gender	Frequency	Percent
Male	56	51.9
Female	52	48.1
Age		
Over 60	35	43.6
Between 50-60	13	15.8
Between 40-50	9	13.1
Less than 40	23	28.5
Occupation		
Retired	22	27.5
Housekeeper	20	25
Army personnel	20	25
Employee	12	15
Student	6	7.5
Education		
Higher degree	30	37.5
Finished high school degree	25	31.3
Unfinished high school degree	12	15
Student	6	7.5
Illiterate	8	8.7

According to the results in Table 1, 52 (48.1%) of the 80 hospitalized patients at Tehran's Besat Hospital were male, while 56 (51.9%) were female. The largest proportion of patients (43.6%) was over the age of 60, followed by those aged 50 to 60 (15.8%) and 40 to 50 (12.0%).

In terms of occupation, the largest group was made up of 22 retirees (27.5%), followed by 20 housekeepers (25%), 20 army personnel (25%), 12 employees (15%), and 6 students (7.5%).

Moreover, 50 patients (62.5%) were married, while 30 of them (37.5%) were single.

In terms of educational degrees, 30 patients (37.5%) had university degrees, 25 (31.3%), finished high-school diplomas, 12 (15%) had unfinished high school diplomas, 6 (7.5%) were students, and 7 (8.8%) were illiterate.

Table 2-Frequency distribution of clinical symptoms in patients

Clinical symptom	Frequency	Percentage
Fever	65	81.3
Cough with phlegm	39	62
Cough without phlegm	23	37.1
tiredness	47	58.8
myalgia	46	57.5
Shortness of breath	39	48.8
Headache	35	43.8
Chest pain	31	38.8
Vomit	18	22.5
diarrhea	14	17.5
Symptoms similar to a cold	12	15
Change in level of consciousness	10	12.5

According to results in Table 2, the most common symptoms were fever above 38 °C in 65 people (81.3%), cough in 62 people (77.5%), of whom 39 people (62%) had coughs with phlegm and 23 people (37.1%) cough without phlegm. Fatigue was reported by 47 people (58.8%), myalgia by 46 people (57.5%), shortness of breath by 39 people (48.8%), headache by 35 people (43.8%), chest pain by 31 people (38.8%), vomiting by 18 people (22.5%), diarrhea by 14 people (17.5%), sore throat, runny nose, and cold-like symptoms by 12 people (15%), and changes in the level of consciousness by 10 people (12.5%).

The patients' symptoms lasted an average of 5 days before they were referred to the treatment Centre, and their hospitalization lasted an average of 5 days. Patients who were older or had an underlying disease were hospitalized for a longer period, sometimes up to 30 days.

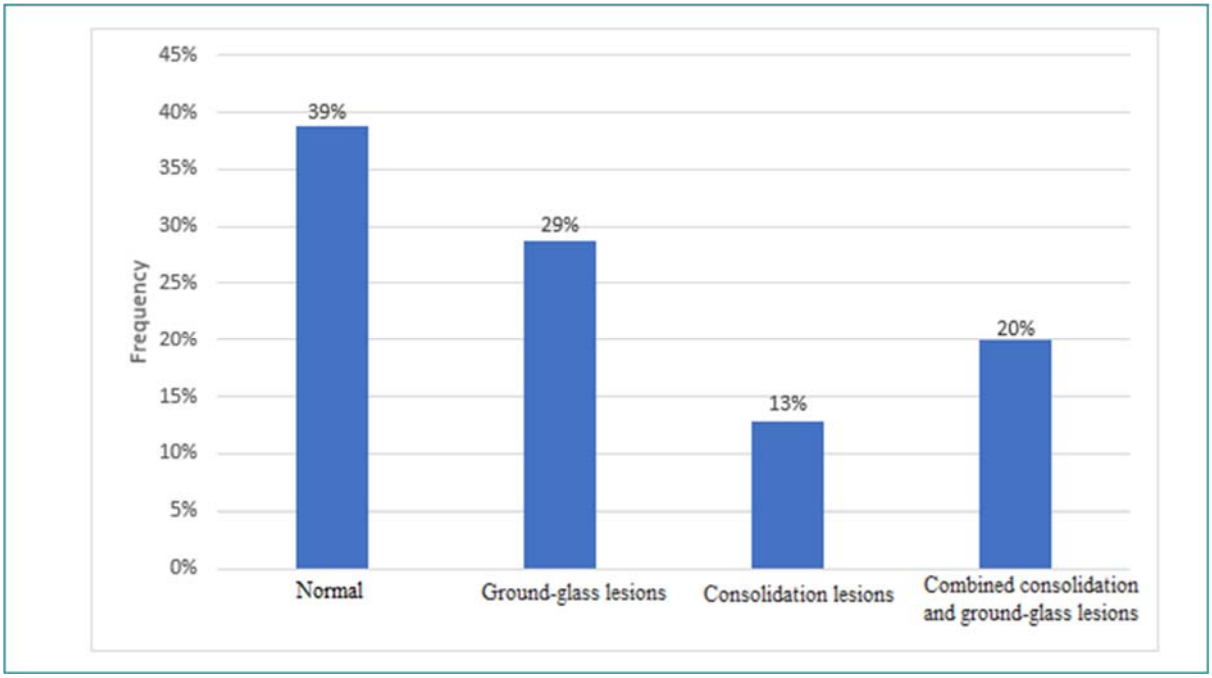

Figure 1. Frequency Distribution of Lung Lesions in Patients' CT Scans

Radiological findings of chest CT scan images of patients show 31 images of normal lungs (38.8%), 23 images with ground-glass lesions (28.7%), 10 images with consolidation lesions (12.9%), and 16 images with combined consolidation and ground-glass lesions. (20%) (Figure 1).

Table 3. Frequency Distribution of Laboratory Results

Laboratory Results	Frequency	Percent
Leukopenia	32	40
Normal leukocyte	38	48.8
leukocytosis	9	11.3
Lymphopenia	50	62.5
Neutropenia	21	26
anemia	32	40
Thrombocytopenia	38	48.5
Normal platelets	41	51.2
Thrombocytosis	1	1.3
Increased ESR	32	42
Increased CRP	65	81
Increased LDH	71	88.8
Increased CKMB	2	2.6

Laboratory Results	Frequency	Percent
Increased CPK	8	10
Increased AST	12	15.2
Increased ALT	4	5.1
Increased ALP	34	42.5

According to the laboratory results (Table 3), leukopenia affected 32 people (40%) while leukocyte counts between 4000 and 10000 were present in 39 people (48.8%) and leukocytosis was present in 9 additional people (11.3%).

A total of 50 people (62.5%) had lymphopenia, 21 had neutropenia (26%) and 32 had anemia (40%)—20 men (38% men) and 12 women (21% women).

In terms of platelet count, 41 people (51.2%) were within the normal range, one person (1.3%) had thrombocytosis, and 38 people (47.5%) had thrombocytopenia.

There were 32 patients (42%) with ESR levels above 20 who had a mean ESR of 23. CRP levels were above 5 in 81 percent of the patients (65), and the average was 22. Only 9 patients (11.2%) fall into the normal category, while 71 patients (88.8%) had LDH levels above 280. 2 patients (2.6%) had CKMB above 25, and the remaining patients were all within the normal range. 38 patients (47.5%) had ALPs in the normal range of 44 to 147, and 34 patients (42.5%) had ALPs higher than 147.

Seventy individuals (90%) had CPKs within the normal range, and the final 10% had CPKs greater than 192. Seventy-six individuals (94.9%) had normal ALT up to 55 and 68 individuals (84.8%) had normal AST up to 48.

Discussion

In this study, the demographic variables, clinical, laboratory, and radiological symptoms, and underlying diseases and prognosis of the patients were investigated. Due to the high prevalence of this disease in the past few years, several studies have been conducted to investigate different variables in influenza, but influenza is a disease that has global importance and can spread not only in human populations but also in animal populations.

For this purpose, 80 patients who met the conditions for entering the study were examined. Among the subjects studied, 52 (48.1%) were men and 56 (51.9%) were women. The largest number of patients (43.6%) were over 60 years old, followed by the age group of 50 to 60 (15.8%), and then 40 to 50 (12.1%), which is consistent with Nabavi et al.'s study (4).

The results of this study showed that, in terms of occupation, 22 patients (27.5%) were retired, 20 (25%) were housekeepers, 20 (25%) were military personnel, 12 (15%) were employees, and 6 were students (7.5%). However, 50 of the studied people (62.5%) were married, and 30 (37.5%) were single.

In terms of education degree, 30 patients (37.5%) had higher education, 25 (31.3%) had finished high school, 12 (15%) had unfinished high school degrees, 6 (7.5%) were students, and 7 (8.8%) were illiterate.

Moreover, based on the findings, the percentage of influenza in men and women is nearly equal. Almost half of the studied population was over 60 years old, and most of them were retired or housekeepers. In terms of education level, more than 60% of the population had high school diplomas or higher degrees.

Radiographic findings were clear and showed no lesions in approximately 40% of patients. The observed lesions were respectively ground-glass, a combination of ground-glass and consolidation, and fewer single consolidation lesions.

In the laboratory results of white blood cells, approximately 50% of patients were in the normal range, followed by leukopenia and a smaller percentage of leukocytosis, with lymphopenia being more common than neutropenia. Forty percent of the population was anemic, and men were more likely to be anemic than women. In terms of platelet examination, half of the population had normal platelets, almost the other half had thrombocytopenia, and leukocytosis was reported in only one patient.

A large population had higher than normal ESR and CRP, and the increase in CRP was more significant. About 90% of patients had LDH levels higher than normal, while most patients had CPK and CKMB levels in the normal range. A large number of patients had normal liver enzymes (ALT and AST), but 42% of patients had higher than normal ALP.

The findings of this study are consistent with the findings of previous studies. For example, in a study conducted by Viroj et al., thrombocytopenia was reported as the most important finding in routine hematological tests (CBC), followed by leukopenia and lymphopenia in patients infected with new types of viruses, including H1N1, H5N1, and H7N1 (12).

These results were repeated in the study by Rodriguez and colleagues (13). In the study of Lopez et al. in Switzerland, the risk of mortality was higher in patients who had thrombocytopenia (14). Ghasemian et al. conducted a study and reported that hematological complications of thrombocytopenia, leukopenia, and anemia have been seen in people with influenza (8).

According to the studies of Ingram et al., procalcitonin and CRP increase in patients with influenza, but they increase less compared to bacterial diseases (11). Finally, Ofer et al. showed

that the serum level of CRP has been proposed as an early factor in predicting the prognosis of patients (10).

It should be noted that the most important limitation of the current study was the onset of the coronavirus pandemic in the fall of 2018 with flu-like symptoms and the lack of early diagnosis, so it was not possible to conduct a study with a larger population. Therefore, it is suggested to conduct a study with a larger sample size to achieve more accurate results.

Conclusions

This study aimed to explore demographic variables, clinical presentations, laboratory results, radiological findings, underlying medical conditions, and patient outcomes among influenza patients. In recent years, due to the increased prevalence of influenza, numerous studies have been undertaken to investigate various aspects of this disease. It is important to note that influenza is a global concern, capable of affecting both human and animal populations.

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Conflict of Interests

The authors declare no conflicts of interest.

Ethical Approval

Informed consent was obtained from all the patients enrolled in this study. Also, this study was approved by the Ethics Committee of AJA University of Medical Sciences.

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