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Research Paper

Investigating the Diagnostic Value of Vision Triage for Screening Patients With COVID-19

Javad Khodadadi[1], Mostafa Vahidian[2], Amir Hossein Safai Moghadam[3], Sepehr Sadeghi[4], Seyed Ahmad Moftakharzadeh[1*], Shabnam Nourabadi[1], Morteza Khoshgoftar[5]

1. Department of Infectious Diseases, Kamkar-Arabnia Medical Education Center, Faculty of Medicine, Qom University of Medical Sciences, Qom, Iran.
2. Department of Family and Community Medicine, Spiritual Health Research Center, School of Medicine, Qom University of Medical Sciences, Qom, Iran.
3. School of Medicine, Groningen University of Medical Sciences, Groningen, Netherlands.
4. Student Research Committee, Tehran University of Medical Sciences, Tehran, Iran.
5. Department of Pediatric Diseases, Faculty of Medicine, Hazrat Masoumeh (S) Medical Education Center, Qom University of Medical Sciences, Qom, Iran.

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ABSTRACT

Background and Aim: This study aims to design and evaluate vision triage for screening patients with coronavirus according to the patient's conditions for hospitalization or discharge of patients with COVID-19.

Materials and Methods: This study measured the tool's value for the clinical triage of COVID-19 patients. In this form, the patient's symptoms, underlying disease, contact with the COVID-19 patient in the last two weeks, and contact with healthcare personnel were evaluated. The diagnosis of COVID-19 was based on a positive real-time transcriptase polymerase chain reaction (PCR) test. We calculated the triage score for each patient based on the clinical form that uses signs and symptoms. In the next step, the sensitivity and specificity of the scored scale were analyzed.

Results: Out of 57 patients who had a negative scoring system, 15 patients (7.5%) had a positive test, and out of 143 patients for whom the scoring system reported a high number, 116 patients (58%) had a positive test. This scoring system's sensitivity, specificity, and positive and negative predictive values were calculated as 88.5%, 60.8%, 81.1% and 73.6%, respectively.

Conclusion: This triage tool will be helpful in better management of patients with COVID-19. This system included clinical findings with high diagnostic accuracy.

*** Corresponding Author:**
Seyed Admad Moftakharzadeh, MD.
Address: *Department of Infectious Diseases, Kamkar-Arabnia Medical Education Center, Faculty of Medicine, Qom University of Medical Sciences, Qom, Iran.*
Phone: *+98 (912) 7599957*
E-mail: *Ahmad.moftakharzade@gmail.com*

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Introduction

In December 2019, many cases of patients who had pneumonia and the cause of their pneumonia was unknown appeared in the city of Wuhan, China [1, 2]. The continuous outbreak of this pneumonia was reported as a severe respiratory syndrome called coronavirus [3]. After isolating the virus from the patient's samples and examining the genome sequences and gene analysis, it was determined that this virus belongs to the coronavirus family and is closely related to the severe acute respiratory syndrome (SARS) virus and the Middle East respiratory syndrome (MERS) virus [4].

In a study, the mechanism of disease transmission was from treatment personnel in 40 cases (29%) and through hospitalized patients in 17 cases (12.3%) [5]. Based on the findings of another study, 99 cases of National Commission on Indigenous Peoples (NCIP) showed that COVID-19 infection affects groups who are in close contact with sick individuals, increasing the likelihood of older men being more susceptible due to underlying conditions. It leads patients to acute respiratory distress syndrome (ARDS) [6].

Knowing the symptoms of this disease is very important. Although the clinical symptoms of this disease are nonspecific, common symptoms mainly include fever, cough, myalgia, and fatigue. Patients may experience nausea and diarrhea before developing a fever. Overall, fever is considered a significant symptom in these patients. A few patients may also present with headaches and hemoptysis [7]. Elderly individuals and those with underlying diseases may experience severe respiratory symptoms due to the destruction of alveoli [8]. This disease can progress rapidly towards progressive involvement and advance in multiple organs (such as shock, ARDS, acute cardiac injury, and acute kidney injury [AKI]) and can even quickly lead to the death of patients [9].

The changes that occur in laboratory tests - white blood cell count, lymphopenia, thrombocytopenia, and increased Prothrombin time (PT) and C-reactive protein (CRP) and other data are currently not sufficient to identify risk factors in severe clinical cases [10]. From the limited data available for COVID-19 patients and by examining information related to related viruses such as SARS-CoV and MERS-CoV, it has been identified that elderly individuals and those with weakened immune systems or chronic diseases are at higher risk of severe illness [11]. Patients with mild clinical symptoms may not initially require hospitalization, but symptoms may worsen in the second week of the progression to lower respiratory tract involvement. All patients should be closely monitored. Possible risk factors for progression to severe illness may include older age, chronic medical conditions such as lung disease, cancer, heart failure, neurological disease, kidney disease, liver disease, diabetes, weakened immune system, and pregnancy [12].

Decision-making for monitoring and caring for a patient in a hospital or outpatient setting should be done on a case-by-case basis. This decision depends not only on the clinical manifestations but also on the patient's ability to quarantine and care for themselves and the risk of transmission in the home environment [13]. The novel 2019 coronavirus appears as a respiratory illness without symptoms in most patients. However, in some patients, it can manifest as respiratory complications (mild pneumonia, severe pneumonia, ARDS), septic shock and, in rare cases, lead to the death of the patient.

Most of the patients have been elderly or immunocompromised individuals. After a medical visit and necessary diagnostic and therapeutic interventions, as well as consultations with other specialized medical fields (if necessary), patients are categorized into several groups and transferred accordingly. Patients without symptoms, following necessary education and instructions for healthcare follow-up, are discharged after completing specific forms for suspected coronavirus patients, registering relevant documents, and obtaining contact information from the emergency department. Hospitalized pneumonia patients in the relevant ward undergo physical isolation with contact/droplet precautions. Patients with severe and critically ill pneumonia who are candidates for admission to special units are transferred after coordination with the admitting hospital. In case of a lack of special beds, after necessary coordination with the responsible physician, the patient is sent to a hospital with available empty capacity.

In summary, given the crisis at hand and the rampant spread of this unknown virus, and considering facilities such as special isolated beds in hospitals, attention to the clinical course and disease manifestations in patients is essential to ensure the best and most accurate hospitalization. It is necessary to consider precise criteria for hospitalizing patients based on hospital conditions and patient needs. Since there is no precise criterion for hospitalizing these patients, this study aims to design and evaluate a visual triage for screening patients with the coronavirus based on patient conditions for hospitalization or discharge of patients with COVID-19.

Table 1. Scoring of signs and symptoms of COVID-19

Scores	Signs and Symptoms
2	Fever above 38 degrees
2	Cough (started or worsened)
2	Shortness of breath
1	Gastrointestinal symptoms: Diarrhea, abdominal pain, vomiting
1	Sore throat, sneezing, runny nose
1	Diabetes, hypertension, anemia (underlying disease)
3	Contact with a person with COVID-19 in the past two weeks
1	Contact with healthcare personnel in the past two weeks

Materials and Methods

This study was conducted in a cross-sectional analytical manner. The research population was the patients of Kamkar Hospital in Qom City, Iran, in 2021. The research sample included all patients visiting Kamkar Hospital who had a polymerase chain reaction (PCR) test for COVID-19. The necessary sample size for this study, considering a disease prevalence of 20% based on field surveys and consultations with experts, a sensitivity of 74%, a clinical triage rate of 18.6% and a 5% error rate based on similar studies' results, was estimated at least 200 individuals who were included in the study using a convenience sampling method [14]. The diagnosis of COVID-19 was based on a positive real-time transcriptase PCR test.

The inclusion criteria for this study were all patients hospitalized during the COVID-19 crisis period who had a PCR test, while patients without a PCR test and those with incomplete information were excluded from the study. In this study, the tool used was calculated based on Alfaraj et al.'s information about COVID-19 [14], and a triage score for each patient was determined based on signs and symptoms (Table 1). In the next step, these findings were compared with those who tested positive or negative for the coronavirus. Finally, after entering the data into SPSS software, version 22, the data were analyzed using the chi-square statistical test. The sensitivity and specificity of this tool were also measured in terms of correctly and timely diagnosing positive cases of COVID-19. A significance level of 0.05 was considered for all tests.

Results

A total of 97 male patients (48.5%) and 103 female patients (51.5%) were included in the study. Among individuals with a positive PCR test, 88 patients (44%) had a fever above 38 degrees, while this number was 29 patients (14.5%) in individuals with a negative PCR. Fever symptom was significantly associated with PCR (P=0.00). Cough symptoms were also present in 74 patients (37%) with a positive PCR and in 24 patients (12%) with a negative PCR, and statistical analysis showed a significant association between cough and a positive PCR (P=0.00). Other symptoms, such as shortness of breath (P=0.365), gastrointestinal symptoms (P=0.612), and rhinorrhea symptoms (P=0.298), did not have a significant association with a positive PCR. Regarding underlying diseases, it was observed in 68 patients (34%) with a positive PCR and in 30 patients (15%) with a negative PCR. A significant association between underlying diseases and a positive PCR test was observed. The association between contact with a confirmed COVID-19 patient in the past two weeks and a positive PCR test was also significant, with 54 patients (27%) connected in individuals with a positive PCR. The association with healthcare personnel in the past two weeks was observed in 38 patients (19%) with a positive PCR and in 10 individuals (5%) with a negative PCR, indicating a significant association between contact with healthcare personnel in the past two weeks and a positive PCR test (Table 2).

Based on the findings in the Table 3, out of 57 patients with a negative scoring system, 15 patients (7.5%) tested positive. Among the 143 patients with a high score ac-

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Table 2. Relationship between findings of visual triage and PCR test for COVID-19

Variables		No. (%)			P
		COVID-19 PCR Test		Total	
		Negative	Positive		
Fever	Below 38°	40(20)	43(21.5)	83(41.5)	0.00
	Above 38°	29(14.5)	88(44)	117(58.5)	
Cough	Does not have	45(22.5)	57(28.5)	102(51)	0.00
	Has	24(12)	74(37)	98(49)	
Shortness of breath	Does not have	41(20.5)	68(5.34)	110(55)	0.365
	Has	28(14)	62(31)	90(45)	
Digestive symptoms	Does not have	64(32)	117(5.58)	181(5.90)	0.612
	Has	5(2.5)	14(7)	19(5.9)	
Sore throat, sneezing, runny nose	Does not have	39(19.5)	61(5.39)	102(51)	0.298
	Has	30(15)	68(34)	98(49)	
Underlying disease	Does not have	39(19.5)	54(27)	93(5.46)	0.034
	Has	30(15)	68(34)	107(5.53)	
Contact with a person with COVID-19	Does not have	67(33.5)	77(5.38)	144(72)	0.000
	Has	2(1)	54(27)	56(28)	
Contact with healthcare personnel in the past two weeks	Does not have	59(29.5)	93(5.46)	152(76)	0.023
	Has	10(5)	38(19)	48(24)	

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cording to the scoring system, 116 patients (58%) tested positive. The agreement rate in this study between visual triage and PCR testing was 0.52, which is considered moderate. The sensitivity, specificity, positive predictive value, and negative predictive value of this scoring system were calculated as 88.5%, 60.8%, 81.1% and 73.6%, respectively (Table 3).

Discussion

Among the patients who ultimately tested positive for COVID-19, 63 patients (31.5%) were male and 68 patients (34%) were female. No statistically significant relationship was found between the gender of patients and the age of patients testing positive for COVID-19. No statistically significant relationship was found between underlying diseases (P=0.03) and COVID testing. Among the clinical symptoms, a statistically significant relationship was found with fever (P=0.00), cough (P=0.00), and shortness of breath (P=0.00) with the COVID-19 test results. However, gastrointestinal symptoms (P=0.61) and rhinitis symptoms (P=0.29) did not show a statistically significant relationship with the patient's test results. We also observed a statistically significant relationship between patients' exposure in the past two weeks to a COVID-19-positive patient and exposure to healthcare personnel in the past two weeks with positive test results. Out of 57 patients with a negative scoring system, 15 patients (7.5%) tested positive, and out of 143 patients reported to have a high score in the scoring system, 116 patients (58%) tested positive. This scoring system's sensitivity, specificity, positive predictive value, and negative predictive value were calculated as 88.5%, 60.8%, 81.1% and 73.6%, respectively.

Wang et al. conducted a study in 2020 to describe the epidemiological and clinical features of patients with coronavirus [7]. In this study, similar to ours, the disease transmission mechanism was seen in 40 cases (29%) from healthcare personnel and in 17 cases (12.3%) from

Table 3. Relationship between the scoring system of patients' symptoms and testing positive for COVID-19

Variables		No. (%)			P
		COVID-19 PCR Test		Total	
		Negative	Positive		
Scoring	0-6	42(21)	15(7.5)	57 (28.5)	0.00
	7-13	27(13.5)	116(58)	143(71.5)	

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hospitalized patients. Additionally, clinical symptoms such as fever were observed in 136 cases (98.6%), fatigue in 96 cases (69.6%), and dry cough in 82 cases (59.4%) [7].

Li et al. conducted a study to examine the epidemiological and clinical characteristics of 17 hospitalized patients with COVID-19 outside of Wuhan, China [15]. The data on these 17 confirmed cases outside of Wuhan were analyzed to present the epidemiological characteristics of nursing care plans (NCP) outside of Wuhan. 12 patients were still quarantined in the hospital, and five were discharged according to national standards. Compared to patients who were not discharged, discharged COVID-19 patients were younger. Additionally, discharged COVID-19 patients had higher heart rate, lymphocyte levels, and monocyte levels than patients who were not discharged. All 17 patients had elevated levels of C-reactive protein, and 16 patients had abnormal CT scans. This study provides some information that younger age, higher lymphocyte levels, and monocyte levels in the diagnosis of 2019-nCoV may help with faster recovery and better treatment outcomes [15].

In another study conducted by Nouri et al. to design a scoring system for triaging COVID-19 patients during the pandemic, it was found that this system can be used to triage patients based on clinical conditions as well as hospital facilities such as hospital beds and equipment like ventilators [16]. The imaging findings of chest CT scans and chest radiographs regarding consolidations and ground-glass opacities in favor of COVID-19 were highlighted in this system. It was also revealed that abnormal findings in the imaging results of these patients have a significant relationship with their follow-up and play an essential role in their triage. Additionally, vital signs of patients upon admission, such as respiratory rate, distress, and SPo_2 levels, were emphasized in this system, showing a significant relationship between unstable vital signs and the clinical status of these patients. Essential laboratory findings in this system included lymphopenia, leukopenia, LDH and CRP, which were of particular value due to the inflammatory conditions in COVID-19 infection, showing that besides platelet count, other laboratory factors were influential in triaging patients [16].

Limited studies have been published regarding the triage of COVID-19 patients. In the study by Salunke et al. variables such as patient age, body temperature, cough, and underlying medical conditions were mentioned as essential factors in triaging these patients, with the similarity of results in our study highlighting the importance of age, underlying medical conditions, and body temperature in triaging these patients [17].

In the study by Salunke et al. references were made to factors such as age, gender, and hypertension in these patients as risk factors. However, our study yielded different results, showing no statistically significant differences in the gender and blood pressure of patients among the three patient groups in triage [18]. However, the initial blood pressure of patients at the time of triage holds particular importance in this triage system, and attention should be paid to all patients' vital signs during triage.

In another study conducted by Duca et al. variables such as respiratory distress, respiratory rate, arterial blood oxygen levels, and chest X-ray abnormalities were mentioned as risk factors in patient triage, which we also included in our study as risk factors in the scoring system and the results also indicated that arterial blood oxygen levels and abnormal chest X-ray findings had an impact on triaging these patients [19].

In the study by Ji et al. laboratory factors such as LDH and blood lymphocyte count were introduced in patient triage, which were examined in our scoring system and were of particular importance [20]. The difference in our study compared to these studies is that in our study, the scoring system included all clinical and paraclinical findings of these patients and summarized them to allocate patients into three groups: Low risk (green), medium risk (yellow) and high risk (red). Given the condi-

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tions of these patients, home care, general ward care, or intensive care unit care can be considered. This scoring system dramatically simplifies the clinical status of the patient. It allows physicians to compare patients with each other and track the progression of the patient's respiratory severity over time. It also allows physicians to more closely monitor patients closer to a critical point of care (e.g. the second level that may require intubation). Furthermore, an attempt has been made in this system to use a modern medical triage system to assign specific color codes to patients and divide them based on the required treatment.

Ultimately, given the high sensitivity, specificity, and diagnostic accuracy of this scoring system, it can be said that the main advantage of this scoring system is that it helps physicians prioritize critically ill patients and transfer them to specialized care promptly, especially in developing countries where medical resources such as ICU beds and ventilators are limited and appropriate use of them is a priority in global epidemics.

Conclusion

This triage tool will be helpful in better managing patients with COVID-19. The system included clinical and clinical findings with high diagnostic accuracy. Although this tool is designed to provide a functional framework for assisting in classifying severity and assessing risk to help manage adult patients (18 years and older) with COVID-19 infection, it is not a substitute for physicians' clinical assessment and judgment of what is best for the patient. On the other hand, this tool needs to be more comprehensive regarding diagnostic and therapeutic recommendations. Patients may present with specific conditions (MI, PE, stroke) or have severe or critical manifestations of COVID-19. These conditions may require other specific diagnostic and therapeutic interventions that are not discussed in this tool.

Ethical Considerations

Compliance with ethical guidelines

This study has been approved by the Ethics Committee of Qom University of Medical Sciences (Code: IR.MUQ.REC.1400.169).

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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References

[1] Rezvan S, Nasiri B, Farahmand H, Ahmadi J, Noori E, Bazmandegan G, et al . Frequency of ABO blood groups in patients with COVID-19 referred to Ali Ibn Abi Taleb Hospital in Rafsanjan in 2020. J Vessel Circ. 2021; 2(4):171-8. [Link]

[2] Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. N Engl J Med. 2020; 382(13):1199-207. [DOI:10.1056/NEJMoa2001316] [PMID] [PMCID]

[3] Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020; 395(10223):497-506. [DOI:10.1016/S0140-6736(20)30183-5] [PMID] [PMCID]

[4] Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med. 2020; 382(8):727-33. [DOI:10.1056/NEJMoa2001017] [PMID] [PMCID]

[5] Phan LT, Nguyen TV, Luong QC, Nguyen TV, Nguyen HT, Le HQ, et al. Importation and human-to-human transmission of a novel coronavirus in Vietnam. N Engl J Med. 2020; 382(9):872-4. [DOI:10.1056/NEJMc2001272] [PMID] [PMCID]

[6] Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. Journal of Autoimmunity. 2020; 109:102433. [DOI:10.1016/j.jaut.2020.102433] [PMID] [PMCID]

[7] Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA. 2020; 323(11):1061-9. [DOI:10.1001/jama.2020.1585] [PMID] [PMCID]

[8] Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: A descriptive study. Lancet. 2020; 395(10223):507-513. [DOI:10.1016/S0140-6736(20)30211-7] [PMID]

[9] Hu B, Guo H, Zhou P, Shi ZL. Characteristics of SARS-CoV-2 and COVID-19. Nat Rev Microbiol. 2021; 19(3):141-54. [DOI:10.1038/s41579-020-00459-7] [PMID] [PMCID]

[10] Wang L, Yang LM, Pei SF, Chong YZ, Guo Y, Gao XL, et al. CRP, SAA, LDH, and DD predict poor prognosis of coronavirus disease (COVID-19): A meta-analysis from 7739 patients. Scand J Clin Lab Invest. 2021; 81(8):679-86. [DOI:10.1080/00365513.2021.2000635] [PMID]

[11] Centers for Disease Control and Prevention (CDC). Interim infection prevention and control recommendations for hospitalized patients with Middle East respiratory syndrome coronavirus (MERS-CoV). Atlanta: Centers for Disease Control and Prevention; 2015. [Link]

[12] Transplant Infectious Disease. Guidance on coronavirus disease 2019 (COVID-19) for transplant clinicians [Internet]. 2019 [Updated 2024 May 31]. Available from: [Link]

[13] Ghorbani J, Safavi Naini A, Jahangirifard A, Raad N, Karimi-Galougahi M, Moradi A, et al. The effect of using the surgical mask on the status of cerebral oxygen saturation and end-tidal carbon dioxide in health care workers. J Otorhinolaryngol Facial Plast Surg. 2022; 8(1):1–7. [DOI:10.22037/orlfps.v8i1.37784]

[14] Alfaraj SH, Al-Tawfiq JA, Gautret P, Alenazi MG, Asiri AY, Memish ZA. Evaluation of visual triage for screening of Middle East respiratory syndrome coronavirus patients. New Microbes New Infect. 2018; 26:49-52. [DOI:10.1016/j.nmni.2018.08.008] [PMID] [PMCID]

[15] Li J, Li S, Cai Y, Liu Q, Li X, Zeng Z, et al. Epidemiological and clinical characteristics of 17 hospitalized patients with 2019 novel coronavirus infections outside Wuhan, China. MedRxiv. 2020; [Unpublished]. [DOI:10.1101/2020.02.11.20022053]

[16] Noori E, Vahedian M, Rezvan S, Minaei N, Tabaraii R. The proposed scoring system for hospitalization or discharge of patients with COVID-19. J Emerg Pract Trauma. 2022; 8(1):60-3. [DOI:10.34172/jept.2021.08]

[17] Salunke AA, Warikoo V, Kumar Pathak S, Nandy K, Mujawar J, Mendhe H, et al. A proposed ABCD scoring system for better triage of patients with COVID-19: Use of clinical features and radiopathological findings. Diabetes Metab Syndr. 2020; 14(6):1637-40. [DOI:10.1016/j.dsx.2020.08.019] [PMID] [PMCID]

[18] Salunke AA, Pathak SK, Dhanwate A, Warikoo V, Nandy K, Mendhe H, et al. A proposed ABCD scoring system for patient's self assessment and at emergency department with symptoms of COVID-19. Diabetes Metab Syndr. 2020; 14(5):1495-501. [DOI:10.1016/j.dsx.2020.07.053] [PMID] [PMCID]

[19] Duca A, Piva S, Focà E, Latronico N, Rizzi M. Calculated decisions: Brescia-COVID respiratory severity scale (BCRSS)/algorithm. Emerg Med Pract. 2020; 22(5 Suppl):CD1-2. [PMID]

[20] Ji D, Zhang D, Xu J, Chen Z, Yang T, Zhao P, et al. Prediction for progression risk in patients with COVID-19 pneumonia: The CALL score. Clin Infect Dis. 2020; 71(6):1393-9. [DOI:10.1093/cid/ciaa414] [PMID] [PMCID]

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