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Does a Low Score in the Respiratory Visual Triage Tool Predict a Negative COVID-19 Test in an Admitted Patient?

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ABSTRACT

Background: Fast and accurate COVID-19 identification is important to population and epidemic monitoring in hospitals. Visual triage or respiratory triage should be efficient and utilized as visual clues to alert HCWs on the case definitions. **Objective:** This study aims to evaluate the diagnostic value of the respiratory triage for COVID-19 infections and to evaluate the efficacy of the MOH triage tool in identifying low risk patients. **Methods:** A single-center retrospective chart review that was conducted at King Fahd Hospital of the University (KFHU), Khober, KSA on all adult patients admitted to the hospital through the ED. The visual triage checklist comprises two main sections, with one focused on the risk of exposure and the other related to patient clinical signs and symptoms, each with a defined score where any score ≥ 4 will need to isolate and assessed by the physician while a score of less than 4 means that the patient can be admitted with other patients. The hospital swabbed all admitted patients regardless of their score. We compared their PCR result with their case definition score. The collected data was entered and analyzed using the Statistical Package for the Social Science (SPSS Inc. Chicago, IL, USA) version 23. **Results:** The study included 7258 participants. 20% of participants aged between 21 to 30 years old, 52.2% of sample were females, and 78% were Saudi nationality. Visual triage score was less than 4 in n= 4745 participants (65.4%) and 4 or more in n= 2513 (34.6%). The test had sensitivity of 75% and specificity 21%. **Conclusion:** Most studies shows that COVID 19 has an infectivity rate of 18 to 30%. Based on this low sensitivity result, using the screening tool alone puts patients and HCWs at risk of getting infected with COVID 19.

Keywords: COVID-19, SARS-2, PCR, MERS-CoV, Respiratory, Triage, Pandemic, Saudi Arabia.

1. BACKGROUND

The A major worldwide million people are affected by the emergent COVID-19 pandemic of serious acute respiratory coronavirus-2 syndrome (SARS-CoV-2) (1). There have been a number of pathogens of infection from epidemiology in the past (2), and the pandemic of 'Spanish influenza' in 1918 had its greatest impact on the international economy and on public health (2). In December 2019 in Wuhan, China, the newly discovered SARS-CoV-2 emerged (3). This is the third extremely deadly human coronavirus after 2002-3 SARS-CoV (renamed SARS-CoV-1) and the 2012-13 Middle East Cow (MERS-CoV) outbreaks (HCoV) (4). Similar to MERS-CoV infections, the incubation time for SARS-CoV-2 is 2-14 days with symptoms of fever, toxicity and breathing difficulty which range from moderate pneumonia to severe disease and even death (1, 4). Too far, the total confirmed cases of COVID-19 after nearly a year after the onset of the virus have risen to more than 76.9 million, including > 1.7 million deaths (5).

Although COVID-19 spreads quickly among many other circulating air viruses, it needs comprehensive diagnostic techniques and screening to track its progress. The chest X and CT scans are the medical procedures for the non-invasive lung test. Suggested test specimens include nasopharyngeal and oropharyngeal swabs as well as sputum, tracheal aspirate, and bronchoalveolary lavage, which may be the reverse transcription-polymerase-chain reaction (RT-PCR). In case of intestinal problems, examining rectal swabs and stool testing is justified in individuals with COVID-19 (7). Pan-Coronavirus-based serological or antibody assessment tests are also popular for defence immunity in several countries in patients recovering with COVID-19. While SARS-CoV-2 immunity and its durability are not well understood, such antibodies can be employed for a broader range of treatments such as plasma therapy.

The WHO has proposed case definitions for COVID-19 that may vary over time in nations or in certain area. Cases with COVID-19 during the fourteen days preceding symptoms (1) are suspected of significant acute respiratory infections necessitating hospitalisation and appropriate description of the clinical look and experience of visiting a high-risk zone or other populated area. Contact, operate in and share health facilities where COVID-19 patients have been treated. In any instance contact a confirmed or alleged case. Consequently, it is probable that people who do not pass the COVID-19 test or for which the SARS-CoV-2 tests are positive and negative for laboratory evidence of other air viruses. The WHO states that a healthy case has laboratory evidence of SARS-CoV-2 infection independent of clinical signs (1, 6).

Fast and accurate COVID-19 identification is important to population and epidemic monitoring in hospitals (8). Present diagnostic methods for coronaviruses include RT-PCR, real-time RT-PCR (rRT-PCR) and reverse-transcription loop (RT-LAMP) isothermal amplification (9). RT-sensitivity LAMP's to the rRT-PCR is quite accurate and is utilised for the detection of MERS-CoV(10). The typical diagnostic evaluation of COVID-19 infection, in accordance with present diagnostic recommendations published by health authorities in many countries, is a laboratory assessment, comprising nasopharyngeal and oropharyngeal swab examinations. The RT-PCR Identification average of SARS-CoV-2 was 38% positive in 4880 patients in one hospital in Wuhan (11). The positive PCR rates are not particularly high in oropharyngeal swabs: 53.3 percent only had positive oral swab tests for COVID-19 patients (12). The findings for RT-PCR are usually positive after two to eight days (13). 71 percent of RT-PCR patients in 51 patients with reported COVID-19 infections were first done for throat swab checks or for sputum samples (14).

Current tests are time-consuming with the absence of commercial kits and can delay or prevent diagnosis. In patients with fever, sore throat, tiredness, coughing, or dyspnea, in conjunction with recent exposures, COVID-19 should be identified with standard chest-computed tomography (CT) features pending negative RT PCR results (15). Of the 1014 patients, 59% got satisfactory results of RT-PCR and 88% had chest CT scans(16). It is not unexpected thus, that COVID-19 is closely related to those found in the SARS-CoV and the MERS-CoV group (17).

The Saudi Ministry of Health (MoH) developed and deployed a visual triage system to be utilised in hospitals to detect acute respiratory illness patients at early stage in EDs, dialysis units and clinics during the MERS CoV spread (18). It comprises nine items separated into two sections, one related to the patient's symptoms and signs, and the other related to the potential risk of patient exposure to MERS-CoV, each with a predefined score. Symptoms of patients include fever, cough, shortness of breath, nausea, vomiting or diarrhoea, sore throat or runny nose, and medical disorders such as diabetes mellitus, chronic kidney failure, coronary artery disease, or heart failure. Before ruling out MERS-CoV, any patient scoring four would require isolation and examination by a doctor.

Since the MERS-CoV illness was initially detected in Saudi Arabia (19), more than six hundred individuals have been killed by the disease. In some instances, visual triage scores may play a crucial role with effective clinical studies in the diagnosis of disease. Due to overpowerment of ED, ED visual triage is important to separating individuals, particularly during an illness epidemic, that may transfer germs to other patients or health professionals. The triage aims to use the data from an unbiased observation of the patient's characteristics to organise emergency care, according to Fitzgerald., et al. (20) The ED visual triage scores play an important role in the first diagnosis of MERS-CoV. Different types of the illness have been explored in prior studies using triage for early detection with encouraging findings. The triage process has two phases: the stage of diagnosis, when the triage band is assigned and processed, and the stage of action to assist the provision of emergency treatment for the patient. Triage findings may be characterised as correct, anticipated, excessive and understated. The proper triage is achieved as the patient is evaluated in the right timeline and reflects a satisfactory clinical result. Triage may usually be seen as a sub-triage that reflects an accuracy greater or lower than necessary. Previous studies suggest that overcontrol and undercontrol can have costly clinical implications which would result in overcrowding of emergency services, increased waiting time for patients and other similar issues (21).Al Marshed et al. shows that visual triage is successful in enforcing quarantine steps for public health and protecting the lives of both patients and healthcare workers, even though only 2% of their sample is diagnosed with the virus molecularly. The study also reported that a very good indicator of infection is the effects of MERS-CoV fever, cough, shortness of breath, runny nose, sore throat, body pain, and prior exposure to the virus. The results of this study reflect the use of MERS-CoV visual triage scoring in Saudi Arabia and other countries experiencing such viral infections (21).

2. OBJECTIVE

The aim of this study was to evaluate the diagnostic value of the respiratory triage for COVID-19 infections and to assess the association between a low score in the visual triage and a negative COVID-19 RT-PCR.

3. MATERIAL AND METHODS

Study setting and design

This is a single-center retrospective chart review that was conducted in a tertiary hospital. As per hospital protocol, any patient going to be admitted was swapped (nasopharyngeal) for COVID-19 for laboratory diagnosis (RT-PCR).

Population

The study was conducted on all adult patients admitted to the KFHU hospital.

Sample size

The study aims for a total coverage sampling technique, including all ED visitors complying to the selection criteria as follows.

Inclusion criteria

a) All patient admitted to hospital for any reason; b) Aged 18 years or above.

Exclusion criteria

a) Any patient known COVID-19 positive or recently infect; b) Any patient who was assessed with primary suspension of COVID-19.

Data collection tool

The visual triage checklist comprises two main sections, with one focused on the risk of exposure and the other related to patient clinical signs and symptoms, each with a defined score where any score ≥ 4 will need to isolate and assessed by the physician. The patient's symptoms include fever, cough, shortness of breath, headache, sore throat, rhinorrhea, nausea, vomiting, diarrhea, or the presence of comorbidity (Appendix 1). COVID 19 swapping was done using nasopharyngeal swabs and diagnosed based on positive RT-PCR.

Data management and statistical analysis

The collected data was entered and analyzed using the Statistical Package for the Social Science. Descriptive statistics was performed. Percentages was given for qualitative variables. The determinant factors was determined using the Chi-square test. P-value was considered significant if $P < 0.05$. Specificity and sensitivity analyses was performed to determine the diagnostic value of the respiratory visual triad for COVID-19 patients. Approval was obtained from the Research Ethics Committee of Imam Abdulrahman Bin Faisal University.

4. RESULTS

According to Table, 1 20% of participants aged between 21 to 30 years old, 21.2% between 31- 40 years old, and 12.2% between 41- 50 years old. 52.2% of sample were females. 78% were Saudi nationality.

Co-morbidities among participants in Table 2, 23.25% of study sample had hypertension, 23.3% had diabetes mellitus.

Chief compliant was respiratory in 5.01% of our sample, general myalgia in 4%, GIT compliant in 10.87%, unspecified compliant 30.6%, and suspected COVID-19 in 1.74% of studied sample as in Table 2.

As illustrated in Table 3. VTS was less than 4 in n= 4745 participants (65.4%) and 4 or more in n= 2513 (34.6%). The test had sensitivity of 27% and specificity 75%.

According to Table 4, 6% of participants had COVID-19 PCR test while 90.3% had SARS-CoV-2 PCR. Only 9.4% of studied sample tested positive for COVID-19 test. Hospital outcome was admission in 0.1%, 1.5% expired, 0.1% absconded and 97.6% discharged.

Parameter		No.	Percent
Age	Less than 10	819	11.3
	11 - 20 years	464	6.4
	21 - 30 years	1448	20.0
	31 – 40 years	1541	21.2
	41 - 50 years	888	12.2
	51 - 60 years	852	11.7
	more than 60	1246	17.2
Gender	Male	3472	47.8
	Female	3786	52.2
Nationality	Saudi	5659	78.0
	Non-Saudi	1599	22.0

Table 1. Sociodemographic characteristics of participants (n=7258)

Parameter		No.	Percent
Co-Morbidities	Cardiology	504	6.9
	Renal	313	4.3
	Anemia	26	0.35
	Respiratory	282	3.88
	Neurological	158	2.17
	Hypertension	1688	23.25
	Dyslipidemia	530	7.3
	DM	1695	23.3
	Stroke	114	1.57
	GIT	14	0.19
	Other	180	2.4
	Unknown	1754	24.2
Admitting diagnosis/ compliant	Abdominal pain/ GIT compliant	789	10.87
	Headache/ Migraine	151	2.08
	Chest pain	20	0.27
	Supervision of other normal pregnancy	606	8.34
	General weakness/ Myalgia	290	4.0
	Respiratory compliant	364	5.01
	Emergent situation	116	1.6
	Unspecified compliant	2218	30.6
	Suspected COVI-19	127	1.74
	Other	2577	35.5

Table 2. Co-morbidities and admitting diagnosis of study sample (n=7258).

Parameter		No.	Percent
COVID-19 Screening Score (Visual Triage assessment)	less than 4	4745	65.4
	4 or more	2513	34.6

Table 3. Visual triage test scores among study participants (n= 7258)

Parameter		No.	Percent
Covid-19 Test Result	POSTIVE	679	9.4
	Neg	6320	87
	Passed	259	3.5
Test	COVID-19 PCR	435	6
	sARS-CoV-2 PCR	6561	90.3
	NON	262	3.6
Hospital Outcome	ABSCONDED	4	0.1
	Discharged	7084	97.6
	EXPIRED	108	1.5
	Admitted	4	0.1
	No Data	58	0.8
Number of days admitted	0 - 10	6053	82.3
	11 -20	746	10.1
	21 - 30	233	233
	31 - 40	143	2
	41-50	61	0.8
	51 - 60	30	0.4
	61 - 70	29	0.4
	71 - 80	14	0.2
	81 - 90	7	0.1
	90 - 100	17	0.2
	more than 100	23	0.3

Table 4. COVID-19 confirmatory test results, test type and outcome, hospital outcome and admission days among participants (n= 7258)

		Hospital Outcome			total	P value
		Negative	passed	POSTIVE		
COVID-19 Screening Score (Visual Triage assessment)	less than 4	4488	51	206	4745	0.001
		71.0%	36.7%	25.8%	65.4%	
	4 or more	1831	88	594	2513	
		29.0%	63.3%	74.3%	34.6%	

Table 5. Association between respiratory visual triages

In Table 5, there was a significant correlation between respiratory VTS and COVID-19 test result as lower scores indicated negative results and higher scores indicated positive results (P= 0.001).

5. DISCUSSION

Separating MERS-CoV patients from non–MERS-CoV patients has proven difficult. As the pandemic progresses and the healthcare system becomes increasingly stressed, this innovative, world-first risk tool has the potential to assist healthcare systems in responding to the COVID-19 pandemic (22).

It is critical that HCWs are well-versed on the case definitions for any new infectious illness to identify and isolate such patients immediately. Case diagnoses are often based on the existence of symptoms and epidemiologic relationships. It is critical to ensure that isolation is carried out correctly and with as little exposure to the patients as possible (18). This necessitates a frequent assessment of MERS-CoV case definition and a reevaluation of the visual triage score to verify its correctness and to prevent overcrowding isolation rooms and straining MoH financial resources by testing suspected MERS-CoV patients excessively (23).

Rever-transcriptase PCR testing for MERS-CoV is the reference standard test for MERS-CoV. 6% of our study participants had COVID-19 PCR test while 90.3% had SARS-CoV-2 PCR. Only 9.4% of studied sample tested positive for COVID-19 test. The study of Alfaraj et al. included 2435 alleged MERS cases occurred during the study period. Of these, 1823 (75%) tested negative and, by PCR assay, the remaining 25% tested positive for MERS-CoV. A comparable proportion of MERS-CoV and non-MERS-CoV patients were found using the visual triage score (VTS), with each score varying from 0 to 11. The sensitivity and accuracy of the scoring system were limited, and for better prediction of MERS-CoV infection, more improvement of the score is needed (22). In our study, VTS was less than 4 in n= 4745 participants (65.4%) and 4 or more in n= 2513 (34.6%). The test had sensitivity of 27% and specificity 75%. There was a significant correlation between respiratory VTS and COVID-19 test result as lower scores indicated negative results and higher scores indicated positive results (P= 0.001). In Alfaraj et al. retrospective examination of the visual triage, the number of patients with a four cutoff rate was 75 percent in MERS-CoV infected patients and 85 percent in non-MERS-CoV infected patients, respectively. For MERS-CoV infection, the sensitivity and accuracy of this cutoff score were 74.1 percent and 18.6 percent, respectively. However, the study found that clinical scoring is not predictive of MERS infection since the results are robust and demonstrate that MERS cannot be discriminated from other respiratory illnesses based on risk factors and clinical characteristics. As a result, all patients with nonspecific symptoms in a MERS-endemic area will have to be quarantined until MERS can be ruled out via PCR testing (23).

Visual triage or respiratory triage should be efficient and used as visual cues to notify HCWs on differential diagnosis in the emergency room (ER), haemodialysis unit, and urgent care units. In the instance of MERS-CoV (24), such visual triage was utilised. The goal of such visual triage is to identify potential cases that satisfy the case description through the use of information derived from objective observation of the patient's features in order to prioritise emergency care (25).

A cross-sectional study was conducted using a scenario-based questionnaire in the Emergency Department (ED) in Bahrain as participants were all Visual Triage nurses and ED triage nurses, nurses rated 66.79% of the cases correctly. Nurses who worked in the ED had an accuracy rate of 66.05%, and those who were from other departments had an accuracy rate of 64.09% (26). In comparison of other studies identified the accuracy of nurses in using emergency triage systems, the destination chosen for patients depended on the score given as cases with scores of less than 6 were considered to be low risk and did not need isolation. A score of 6 or more indicated a high-risk case that must be placed in an isolation room (27, 28).

6. CONCLUSION

Low scores of respiratory visual triages indicates negative COVID-19 test results. VTS had sensitivity of 27% and specificity 75%. This approach has a significant consequence in standings of public health to limit the spread of COVID-19 infection. This is principally applicable in countries where access to quick diagnosis is rare. Future studies with large sample size are recommended to support our results.

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