Evaluation of visual triage for screening of Middle East respiratory syndrome coronavirus patients

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Abstract

The emergence of Middle East respiratory syndrome coronavirus (MERS-CoV) in September 2012 in Saudi Arabia had attracted the attention of the global health community. In 2017 the Saudi Ministry of Health released a visual triage system with scoring to alert healthcare workers in emergency departments (EDs) and haemodialysis units for the possibility of occurrence of MERS-CoV infection. We performed a retrospective analysis of this visual score to determine its sensitivity and specificity. The study included all cases from 2014 to 2017 in a MERS-CoV referral centre in Riyadh, Saudi Arabia. During the study period there were a total of 2435 suspected MERS cases. Of these, 1823 (75%) tested negative and the remaining 25% tested positive for MERS-CoV by PCR assay. The application of the visual triage score found a similar percentage of MERS-CoV and non−MERS-CoV patients, with each score from 0 to 11. The percentage of patients with a cutoff score of ≥ 4 was 75% in patients with MERS-CoV infection and 85% in patients without MERS-CoV infection (p 0.0001). The sensitivity and specificity of this cutoff score for MERS-CoV infection were 74.1% and 18.6%, respectively. The sensitivity and specificity of the scoring system were low, and further refinement of the score is needed for better prediction of MERS-CoV infection.
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Introduction

The first case of Middle East respiratory syndrome coronavirus (MERS-CoV) was described in 2012 from a hospitalized patient in a private hospital in the Kingdom of Saudi Arabia [1]. The disease has attracted the attention of the global heath community because it carries a high fatality rate of 40% to 60% [2−5]. The high case fatality rate could be an overestimate because the exact numbers of asymptomatic and mild cases were not well defined. Recent estimates indicate an overall fatality rate of 35%. Over the 4 years since the virus's discovery, there have been multiple healthcare-associated outbreaks [2,3,6−15]. The main reason for these outbreaks was the difficulties in early identification of MERS-CoV confirmed cases from influenza-like illness cases, leading to inappropriate application of infection control standards and quarantine. In an effort to facilitate this task, differentiation between MERS-CoV and non−MERS-CoV cases based on epidemiologic and clinical indicators was evaluated in few studies, but with no helpful findings [16−18]. A case−control analysis identified some

significant predictors in univariate but not in multivariate analysis [16]. In other studies, presenting symptoms were not specific for MERS-CoV infection [17,18].

The Saudi Ministry of Health (MoH) developed and released a visual triage system to be used by all hospitals for the early identification of patients with acute respiratory illness in EDs, dialysis units and clinics [19]. In this study, we retrospectively evaluated the performance of this visual acute respiratory illness triage system for the prediction of MERS-CoV infection.

Patients and methods

Prince Mohammed bin Abdulaziz Hospital is a referral centre for MERS-CoV patients diagnosed in the central region based in Riyadh, Saudi Arabia. The visual triage form documents the institution, unit, healthcare worker involved in the triage with name and signature, and patient contact details (Fig. 1). It comprises nine items classified into two sections, with one related to the patient's symptoms and signs and presentation and the other section related to the patient's potential risk of exposure to MERS-CoV, each with a defined predetermined score (Fig. 1). The patient's symptoms include fever, cough, shortness of breath, nausea, vomiting or diarrhea, sore throat or runny nose and the presence of underlying conditions including diabetes mellitus, chronic renal failure, coronary artery disease or heart failure. Any patient scoring ≥4 will need isolation and assessment by a physician before ruling out MERS-CoV. All admitted patients from 1 April 2014 to December 2017 who were tested for MERS-CoV were included in this study. MERS-CoV testing was done using nasopharyngeal swabs as described previously [4]. MERS-CoV diagnosis was based on positive real-time reverse-transcriptase PCR as described previously [4,16,20].

We calculated the triage score for each patient on the basis of the scores from Saudi MoH [19] using the identified signs and symptoms. The percentage of patients with the specified score was calculated and compared between those with and without MERS-CoV infection using a chi-square test.

We then calculated the sensitivity and specificity of the scoring scale adopted for the identification of positive cases in relation to virus detection by real-time PCR. Sensitivity and specificity were calculated, for an original cutoff value of 4. We subsequently challenged the triage scoring by increasing the values of MERS-CoV potential exposure specific items 7 to 9 by giving 6 points for factor 7 instead of 3, 4 points for factor 8 instead of 2 and 2 for factor 9 instead of 1. We then calculated sensitivity and specificity in the same manner.

Results

During the study period from 2014 to 2017, there was a total of 2435 suspected MERS-CoV cases. Of these, 1823 cases (75%) tested negative and the remaining 25% tested positive for MERS-CoV by PCR. The application of the visual triage score resulted in a similar percentage of MERS-CoV and non–MERS-CoV patients with each score from 0 to 11 (Fig. 2). The percentage of patients with a cutoff score of ≥4 was 75% in patients with MERS and 85% in patients without MERS (p 0.0001). The sensitivity and specificity of this cutoff score for MERS-CoV infection were 74.1% and 18.6%, respectively. Increasing the values of items 7 to 9 and recalculating the score, as indicated above, was not discriminative as well.

Discussion

We retrospectively evaluated the proposed Saudi MoH triage scoring system for the screening of MERS-CoV patients. During the outbreak of severe acute respiratory syndrome, one

	A. Clinical symptom/sign	Points	Score
1	Fever (≥38°C)	2	
2	Cough (New or worsening)	2	
3	Shortness of breath (New or worsening)	2	
4	Nausea, vomiting, diarrhea	1	
5	Sore throat and/or runny nose	1	
6	DM, Chronic renal failure, CAD/heart failure	1	
	B. Risk of exposure to MERS		
7	Exposure to a confirmed MERS case in last two weeks	3	
8	Exposure to camel or products (Direct or indirect*) in the last two weeks	2	
9	Visit to health care facility that has MERS case in last two weeks	1	
	Total Score		

* Patient or household

FIG. 1. Visual triage form showing two sections, one related to patient presenting symptoms and signs and one related to risk of exposure to MERS-CoV. CAD, coronary artery disease; DM, diabetes mellitus; MERS-CoV, Middle East respiratory syndrome coronavirus.