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Research Article

Rate of COVID Positivity among Admission Screening in Governmental Hospital with Correlation of Ct Value & Outcome among Positive Cases

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Abstract

Background: There is limited evidence regarding the utility of testing individuals who are asymptomatic, such asymptomatic COVID-19 individuals tend to have higher Ct-value and tend to have better prognosis.The aim of this study is to illustrate the rate of positivity among admission screening to SMC & study their outcome and compare the age, sex and Ct-value of asymptomatic COVID-19 individuals with their counterpart symptomatic hospitalized COVID-19 patients.

Method: Retrospective observational analysis of all patients admitted to SMC during one month study period.

Results: During the study period, total of 3101 patients were admitted to SMC, out of which 396 were referred as symptomatic COVID-19 patients, while among the remaining (2705) admitted patients they were all asymptomatic for SARS-CoV-2 infections but screened at the time of admission to the hospital by PCR testing, out of which 21 patients only turned to be positive for SARS-CoV-2 infections (<1%). Among hospitalized COVID-19 patients, advance age found to be strong predictor of disease severity & mortality, while lower Ct-Value found to be strong predictor of disease severity, but not of mortality. Sex was not found to be predictor of disease severity or mortality among our hospitalized COVID-19 patients.

Discussion & Conclusion: Rate of positivity among admission screening in SMC was very low. Among hospitalized COVID-19 patients, advance age & lower Ct-value on admission found to be strong predictor of disease severity, further studies are needed before generalization of the application of Ct-Value as surrogate marker for disease severity.

Keywords: Ct-value; COVID-19; SARS-CoV-2; Asymptomatic; Mortality

Introduction

There is limited evidence regarding the utility of testing individuals who are asymptomatic and such practice is generally not recommended on routine practice. Presently, testing of individuals who are asymptomatic with no known exposure is usually indicated only in the context of pilot or systematic surveillance activities to generate the knowledge needed to make future evidence-informed decisions and such screening should always be driven by local epidemiology [1-5].

One of the indication for screening of asymptomatic individuals is testing before admission to a health care facility [6,7], since 25th June 2020; universal admission screening was implemented in Salmaneya Medical Center (SMC) which is the main governmental hospital in Bahrain to test all patients upon admission (those without signs or symptoms of SARS-CoV-2 infection who are planned for admission under different specialties in SMC) with an intention to identify the group of asymptomatic or pre-symptomatic SARS-CoV-2 infection to minimize the risk of nosocomial transmission in the hospital.

If such screening test results are positive, the surgery, procedure or elective admission will likely to be rescheduled. For

those patients whose procedures or scheduled admission cannot be rescheduled for medical reasons, strict adherence to recommended isolation precautions will be reinforced.

Asymptomatic SARS-CoV-2 infections have been well documented, but the proportion of infections that are asymptomatic and their progression & outcome has not been systematically and prospectively studied [8-12].

Asymptomatic individuals tend to have higher Ct-value upon admission and usually had better prognosis in comparison to other symptomatic COVID-19 patients [13-17].

The aim of this study is to illustrate the rate of positivity among admission screening to SMC & study the outcome of such asymptomatic patients and compare the age, sex and Ct-value of asymptomatic COVID-19 individuals with their counterpart symptomatic hospitalized COVID-19 patients in the main governmental hospital in the Kingdom of Bahrain.

Materials and Methods

Setting & Study Population

This study was conducted at SMC which is the main governmental hospital in the kingdom of Bahrain. All patients who were admitted to the center during one month period (25th June-25th July, 2020) were identified from hospital medical record database system & included in the study. Demographic & clinical data were collected from electronic medical records for all included patients.

Design

Retrospective observational analysis of all patients admitted to SMC during the study period.

Definition: Laboratory identification of SARS-CoV-2 infections: All patients confirmed to have SARS-CoV-2 infections by positive testing using real-time reverse transcriptase PCR for nasopharyngeal or deep tracheal aspiration samples. Ct-value was documented for all positive tests. The first Ct-value upon admission to SMC was considered for this study analysis.

Symptomatic COVID: Categorization of clinical severity was in reference to the national COVID protocol in the kingdom of Bahrain [18].

Mild: fever with symptoms of upper respiratory tract only and absence of pneumonia.

Severe: fever with any of the following : shortness of breath, tachypnea > 20 breaths /minutes or hypoxia (saturation less than 94% on RA) or chest radiography showed evidence of pneumonia.

Mortality: This outcome was considered for all admitted COVID-19 patients. Death (All-cause mortality) was defined based on the status of the patients at the time of discharge from the COVID facility (Alive/Dead).

Statistical Analysis

For the statistical analyses, data was analyzed using SPSS Statistics (IBM SPSS Statistics, Released 2015, Version 23.0, Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages while means and standard deviations were computed for continuous variables. Comparisons among the groups were performed using Chi-square Test (χ^2) or Fisher's exact test (two-tailed) for categorical variables and the independent samples t-test or analysis of variance (ANOVA) for continuous variables. For all data, a p-value ≤ 0.050 was considered statistically significant.

Ethical approval

The study was approved by the Secondary Care Research Committee of Salmaniya Medical Complex, Ministry of Health, the Kingdom of Bahrain and by the national COVID research committee. The study had no ethical consideration as it was non-interventional study with no disclosure to any patient data.

Results

During the study period, total of 3101 patients were admitted to SMC, out of which 396 were referred as symptomatic COVID-19 patients and was admitted under the Infectious diseases or pulmonology specialist based on the severity of illness, while among the remaining (2705) admitted patients they were all asymptomatic for SARS-CoV-2 infections but screened at the time of admission to the hospital by PCR, out of which only 21 patients turned to be positive for SARS-CoV-2 infections (<1%), as shown in Table 1 below; there was no any statistically significant difference among different age group or gender, while among different admission specialties, it was clear that big proportion (42%) of positive patients were under the gynecology specialty.

		Negative Screening n=2684	Positive Screening n=21	P-Value
	Sex, males	1084 (40.39%)	9 (42.86%)	0.818
	Age, mean ± SD	35.09 ± 19.5	38.14 ± 16.22	0.474
Specialty	Gynecology	725 (27.01%)	9 (42.86%)	<0.001
	Obstetric	334 (12.44%)	2 (9.52%)	
	Pediatrics	281 (10.47%)	2 (9.52%)	
	Hereditary Blood Disorder	230 (8.57%)	0 (0%)	
	Cardiology	156 (5.81%)	3 (14.29%)	
	General Surgery	148 (5.51%)	0 (0%)	
	Orthopaedics	131 (4.88%)	0 (0%)	
	General Medicine	116 (4.32%)	0 (0%)	
	Neurology	95 (3.54%)	3 (14.29%)	
	Other surgical specialties*	187 (6.97%)	0 (0%)	
	Other medical specialties**	218 (8.12%)	0 (0%)	
	Others***	63 (2.35%)	2 (9.52%)	

*Urology (n=55), neurosurgery (n=48), vascular surgery (n=36), Pediatric surgery (n=30), plastic surgery (n=12) and dental surgery (n=6); **Nephrology (n=84), gastroenterology (n=42), hematology (n=38), endocrinology (n=22), oncology (n=22), Rheumatology (n=8), dermatology (n=2); ***Others: Negative screening group: Psychiatry (n=2), ophthalmology (n=36) and Ear nose and throat (n=25), positive screening group: ophthalmology (n=1) and Ear nose and throat (n=1).

Table 1: Comparison between negative and positive screening groups.

As demonstrated in Figure 1 below, total number of COVID-19 patients who were admitted during the month of study was 396, out of which 21 (5.3%) were totally asymptomatic (just discovered on admission screening), 204 (51.5%) presented with mild symptoms, while 171 (43.1%) presented with severe symptoms.

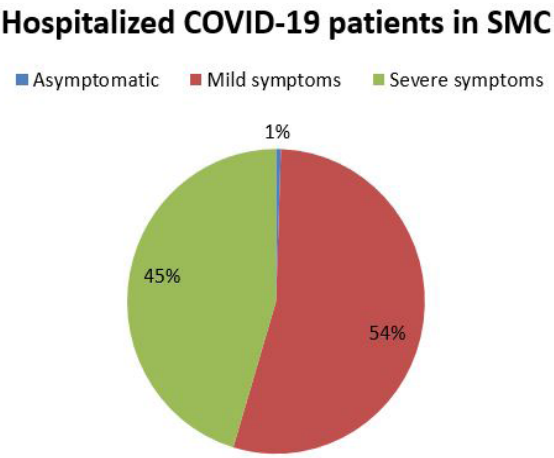

Figure 1: Hospitalized COVID-19.

Among such group of asymptomatic COVID-19 patients, their mean age was 38.1 (38.14±16.22) proportion of male was 42.9%, their mean Ct-value 27.6 (27.57±7.11), comparing this group with the symptomatic COVID-19 patients, we found that male was predominant among the group of mild symptoms, while the mean age was higher among the group who presented with severe symptoms, Ct-value also found to be higher among asymptomatic patient and lowest among patients with severe symptoms (Table 2).

Total COVID-19 patients n=396	Asymptomatic n=21	Mild symptoms n=204	Severe symptoms n=171	P-Value
Sex, males	9 (42.86%)	108 (52.94%)	64 (37.43%)	0.011
Age, mean±SD**	38.14±16.22	42.25±20.69	56.30±14.85	<0.001
CT value*, mean±SD**	27.57±7.11	24.20±4.85	24.02±5.17	0.011
Outcome, Dead	0 (0%)	0 (0%)	22 (12.87%)	<0.001
*CT: Cycle Threshold; **SD: Standard Deviation				

Table 2: Comparison between asymptomatic, mild symptoms, severe symptoms groups.

Table 3 illustrate the mortality among hospitalized COVID-19 patients, gender was not a risk factor for mortality, but advance age was significant predictor of high mortality, with regard Ct-value, it found to be lower among the dead group (24.42±5.10 for alive vs. 22.35±6.10 for dead), but the difference was not statistically significant (p value 0.069). The outcome of all patients who were asymptomatic & those who presented with mild symptoms upon admission were satisfactory (all alive upon discharge), while 22 patients among the 171 with severe symptoms on admission died (mortality of 14.76%).

		Alive N=374	Dead n=22	P-Value
Sex, males		171 (45.72%)	10 (45.45%)	0.980
Age, mean±SD**		47.10±19.26	65.00±15.56	<0.001
CT value*, mean±SD**		24.42±5.10	22.35±6.10	0.069
Severity	Asymptomatic	21 (5.61%)	0 (0%)	<0.001
	Mild symptoms	204 (54.55%)	0 (0%)	
	Severe symptoms	149 (39.84%)	22 (100%)	
*CT Cycle Threshold; **SD: Standard Deviation				

Table 3: Comparison between the outcomes (Alive or dead).

Discussion

Rate of positivity among admission screening to SMC of patients was very low (<1%) and the biggest proportion of positive cases was under gynecological admission , this should raise the question about the need of continuing such universal screening or to make it selective and target the high risk population (gynecological admission).

The current knowledge about the predictor of COVID-19 disease severity & mortality is still limited, some of the predictor that have been studied previously was the age, sex & Ct-value of the PCR testing.

Ct value is the Cycle threshold of Polymerase Chain Reaction (PCR) testing which is defined as the number of cycles needed to amplify viral RNA to reach a detectable level, theoretically; specimens with lower Ct-values tend to have more viral RNA than specimens with higher Ct-values. Among SARS-CoV-2 infection; Ct-value have gained a publicity as a potential marker for disease severity and several studies had pointed to a link between this viral load marker and severity of disease.

Our study revealed that Ct-value was strongly correlated with the severity of symptoms, this is in agreement with a systematic review that have been published recently and concluded an association between lower Ct values and severe symptoms [17].

But we should take our results with caution, as many other previous studies had concluded that Ct-values should not be used as a direct measure of SARS-CoV-2 viral load in clinical samples

[19], and its utilization as surrogate marker for disease severity is questionable [20], considering that Ct-values are not standardized across RT-PCR platforms and its results cannot be compared across different tests, also it was found that Ct-values from viral RNA can vary depending on the specimen source, its method of collection, and the time from infection to collection of specimen [21].

Advance age & male gender also found to be an important predictor of disease severity & mortality in many previous studies worldwide [22], in our study advance age strongly correlated with disease severity & mortality, while male sex was not found to be significant predictor for mortality or disease severity among our population study.

Conclusion

Rate of positivity among admission screening in SMC was very low. Among all hospitalized COVID-19 patients, advance age found to be strong predictor of disease severity & mortality. Ct-Value found to be strong predictor of disease severity, but not of mortality. However, further study is needed on how to best clinically utilize Ct values given the result variation due to specimen quality, phase of disease, and the limited discriminative ability of the test.

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