Rapid SARS-CoV-2 Antigen Detection Assay versus Real-time-PCR Assay for Laboratory Detection of COVID-19

Shymaa Hamdy Mohamed Zaglool*[a], Alaa Rashad Mahmoud Mohamed[b], Esraa Abass Abdallah[a], Fayed HM[a]

[a] Clinical & Chemical Pathology Department, Faculty of Medicine, South Valley University, Qena, Egypt.
[b] Pulmonology Department, Faculty of Medicine, South Valley University, Qena, Egypt.

Abstract

Background: real-time polymerase chain reaction (RT-PCR) of nasal/oropharyngeal samples is the gold standard in detecting SARS-CoV-2 infection, however, it has a long turnaround time.

Objectives: To meet the growing epidemic demand, we evaluated the performance of rapid SARS-CoV-2 antigen tests in detecting COVID-19 infection compared to RT-PCR.

Patients and Methods: a cross-sectional study involving adults suspected to have mild or moderate COVID-19 infection severity scores over 6 months from 1/10/2021 to 1/4/2022.

Results: from 186 patients assessed, 88(47.3%) males and 98 (52.7%) females with a mean age of 52.55 ± 20.15 years, and a mean disease duration of 13.1± 4.5 days. 57(30.6%) cases of RT-PCR were positive and 129(69.4%) cases were negative. Meanwhile, in rapid antigen tests, 49(26.34%) cases were positive and 137(73.35%) cases were negative. The receiver operator characteristic (ROC) curve predicts the performance of rapid antigen tests revealing an overall agreement with the RT-PCR results, with 85% sensitivity (95% CI, 73.43% - 92.90 %), 98.54% specificity (95% CI, 94.83% - 99.82%), 96.23% PPV (95% CI, 86.52% - 99.02%), 93.75% NPV (95% CI= 89.14% - 96.48%), 94.42% accuracy (95% CI, 90.23% - 97.18%), and with 0.918 the area under the curve.

Conclusion: Although RT-PCR is still the gold standard for detecting SARS-CoV-2 infections, the rapid SARS-CoV-2 antigen test offers good sensitivity, specificity, PPV, NPV, and a significantly short turnaround time. As a result, it has great clinical utility as a primary frontline test for detecting infected patients in an emergency setting.

Keywords: Viruses; Diagnostic challenges; Rapid SARS-CoV-2 antigen, RT-PCR.

***Correspondence**: shymaazaglool@yahoo.com

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Introduction

Since the first case was identified in Wuhan-China in December 2019, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)-caused coronavirus disease 2019 (COVID-19) pandemic has spread across the globe. The World Health Organization (WHO) has issued a universal alert and stated that individuals who are suspected of having COVID-19 must have access to a testing system **(WHO, 2020).** SARS-CoV-2 is known to spread even among infected individuals who have only minor symptoms or who are asymptomatic carriers**.** As a result, in some areas, testing needs to be extended to those who are asymptomatic **(Rothe et al., 2020).**

In standard clinical practice, reverse-transcription real-time polymerase chain reaction (RT-PCR) analysis is used to identify SARS-CoV-2 infection **(Corman et al., 2020).** However, the RT-PCR test is not rapid (results normally take 3–4 hours), and it also needs specialist lab equipment and skilled lab personnel, whereas antigen testing is simple and may be routinely performed in clinical laboratories **(Lai et al., 2020).**

The goal of the study was to evaluate the performance of the rapid SARS-CoV-2 antigen test compared to RT-PCR in detecting COVID-19 infection in Qena University Hospital, a tertiary care hospital.

Patient and Methods

A cross-sectional study included 186 adult patients suspected to have COVID-19 infection, admitted to the chest department and clinic at Qena University Hospital, over 6 months from 1-10-2021 to 1-4-2022.

a. Inclusion criteria: All symptomatic adults patients (age > 18 years old) of both sexes suspected to have COVID-19 infection and were scored according to the WHO (2021a), patients with mild disease have fever (≥ 37.5℃), cough, lethargy, upper respiratory symptoms, and/ or less common symptoms (headache, loss of taste or smell, etc.). Patients with moderate disease have lower respiratory symptoms. They may have infiltrates on the chest X-ray. These patients can maintain oxygenation saturation on atmospheric air.

b. Exclusion criteria: All asymptomatic, or patients with severe or critical COVID-19 disease, pregnant females, or cases with associated comorbidities were excluded from the study.

Ethical considerations: The study protocol was approved by the local institutional Ethical Research Committee of the Qena Faculty of Medicine, and informed written consent was obtained from all patients.

The ethical approval code is SVU – MED – CCP031 – 1 – 21 – 10 – 259 .

Laboratory assessment: All laboratory tests were evaluated on the day of admission, and in the same laboratory using the standard operating procedures.

- **A sampling at first the presentation:**

a) **Posterior nasopharyngeal (PNP)** two swabs were collected for comparative analysis by inserting a sterile swab into the nostril of the patient over the surface of the posterior nasopharynx and then, rotated 3-4 times against the nasopharyngeal surface. Then withdraw the swab from the nasal cavity. Then, they were manipulated according to test instructions.

- The PNP samples were tested immediately after collection for rapid SARS-COV-2 antigen testing.
- For RT-qPCR, the PNP swabs were collected in a universal transport medium for molecular testing, in a hand refrigerator (at +2-+8 °C) from the spot of sampling to the laboratory. Samples were, held refrigerated at 4°C and tested within 12 hours of collection, as the analyses were organized daily.

b) **Blood sample**: 5 ml venous blood samples were collected under aseptic conditions and divided into 3 tubes: 2 ml blood in an EDTA tube for complete blood count (CBC), 1.8 ml blood in a citrate tube for prothrombin time and D-dimer, and a plain tube for CRP. The clotted blood was centrifuged at 3000 x g for 10 minutes at room temperature to obtain serum.

1. **CBC**: using Cell Dyne-Ruby automated cell counter (Abbott Diagnostics -Santa Clara-Ca-USA) and the manual differential count was done using Leishman's stain.
2. **CRP:** using Beckman Coulter AU 480-CA-USA for quantitative turbidimetric detection of CRP, Cat No. OSR6147. In healthy adults, CRP level ranges from 0 to 8 mg/L.
3. **D-Dimer:** using particle-enhanced D-Dimer assay with immune-turbidimetric application

on automated blood coagulation analyzer CS-1600. Sysmex Corporation Dade Behring. CA analyzers Kobe, Japan. A normal D-dimer is considered less than 0.5 µ/mL.

4. **Real-time polymerase chain reaction (RT-PCR):** for the qualitative detection of nucleic acid from the SARS-CoV-2 from PNP patients' samples, using fully automated sample prep using QIAamp DSP spin mini Elute-column viral RNA nucleic acid kit extraction and purification protocol on QIACUBE Connect (QIAGEN GmbH, Hilden, Germany).

Reaction, amplification conditions, and result interpretation were performed according to the manufacturer's instructions. Focused on viral loads, a two-step approach was used, a qualitative RT-PCR followed by a quantitative one. The reverse transcription and amplification were performed using Rotor-Gene Q (QIAGEN, Hilden, Germany). Firstly, samples were screened for SARS-CoV-2 RNA by qualitative RT-PCR. Secondly, for the detection of SARS-CoV-2 viral load, positive samples were also analyzed by RT-qPCR. COVID-19 Genesig Real-Time PCR Kit (Primer Design Ltd., Chandler's Ford, UK). Samples showed an exponential growth curve with any cycle threshold (Ct) value considered positive, and the PNP swabs with SARS-CoV-2 RT-qPCR Ct ≤ 35 positive**s.**

5. **Rapid SARS -COV 2-antigen test:**

A chromatographic immunoassay was used in patients with clinical symptoms of SARS-CoV-2 infection for the qualitative detection of SARS-CoV-2 proteins in PNP swabs. The using Standard Q COVID-19 Ag test, Cat No.09cov30d (SD Biosensor INC), South Korea. The test was performed according to the manufacturer's instructions. The sensitivity (Ct<25) is 97.14% (68/70, 95% CI 90.06-99.65%), and the sensitivity (Ct<33) is 90.71% (127/140, 95% CI 84.64-94.96%).

6. **Radiological assessment:**

a) **Computerized tomography (CT) scan**: using scanner Gantry Model CGGT-021A, Japan. Data extracted either consisted of normal CT findings or revealed the characteristics of the diagnostic patterns as previously reported **(Sharif et al., 2022).**

b) **Chest X-RAY (CXR):** using Proteus XR/I system floating top table model A6563-01, (GE health care, Spain). All CXRs were obtained as computed digital radiographs at the time of the presentation. Imaging findings were analyzed as previously reported **(Yasin and Gouda, 2020)**

Statistical analysis

The data analysis was done using Statistical Package for social sciences (SPSS) software program (version 26). The Kolmogorov-Smirnov test was used to verify the normality of distribution. Qualitative variables were recorded as frequencies and percentages and were compared by the Chi-square test in normally distributed data and Fisher's exact test in abnormally distributed data. The quantitative measure was presented as means ± standard deviation (SD) and in normally distributed data compared by Student t-test or by Mann-Whitney test in abnormally distributed data.

Results of the rapid COVID-19 Ag tests were compared to those of RT-qPCR, which was considered the gold standard for this evaluation (positive and negative results obtained by RT-PCR were considered to be truly positive and true negative results, respectively). To determine the predictive validity of the rapid SARS COV 2-antigen test and the level of its agreement with the RT-PCR test, the receiver operating characteristic (ROC) Curve was constructed to determine the performance of rapid antigen test sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), accuracy and their 95% CI were calculated. All tests were two-tailed and statistical significance was set at the value of $p < 0.05$.

Results

This cross-sectional study involved 186 patients with mild and moderate severity COVID-19 infection, the age ranged between 21 years and 95 years, 88(47.3%) males and 98 (52.7%) females with a mean age of 52.55 ± 20.15 years, and a mean disease duration of 13.1± 4.5 days. The age group of more than 60 years was the most frequent (41.6%) followed by the age group of 18-30 years in 23.9% of cases, the age group of 31-50 years in 17.8% of cases, the age group of 51-60 years in 11.7% cases. The disease duration ranged

from 3 days to 26 days with a mean duration of 13.11± 4.49 days. **(Fig.1).**

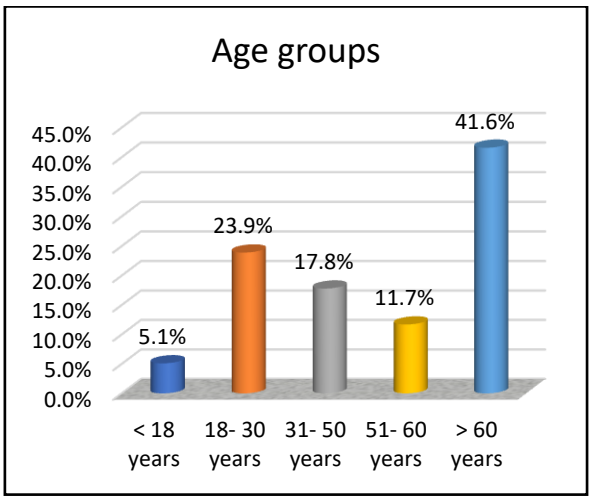

Fig.1. Age groups of the studied cases

Regarding radiological findings, 85(45.70%) of cases were free of radiological abnormalities, 83(44.62%) cases had ground glass opacity (GGO), 13(6.99%) cases had pneumonia, 6(3.23%) cases had pleural effusion, 2(1.07%) cases had emphysema, 1(0.54%) cases had atelectasis, 1(0.54%) case had a pulmonary embolism, and 1(0.54%) case had lung fibrosis. **(Table .1).**

Table 1. Radiological findings of the studied cases

Radiological findings*	Studied cases (N= 186)	
	N	%
Radiologicaly free	85	45.70%
Ground glass opacity (GGO)	83	44.62%
Pneumonia	13	6.99%
Pleural effusion	6	3.23%
Emphysema	2	1.07%
Atelectasis	1	0.54%
Pulmonary embolism	1	0.54%
Lung fibrosis	1	0.54%

*Mutual findings may be found

Radiological findings concerning other clinical and laboratory data: Age, disease duration, PT, and were significantly higher in cases with abnormal radiological findings compared to cases free of radiological abnormalities, while Hb, RBCs, and HCT were significantly lower in cases with abnormal radiological findings compared to cases free of radiological abnormalities. (**Table .2**)

Table 2. Radiological findings concerning clinical and laboratory data

Variables	Radiological findings						Mann-Whitney U Test	
	Normal (no=85)			Abnormal (no=101)			Test value	P-value
	Mean	SD	Median	Mean	SD	Median		
Age (years)	41.09	19.04	32	62.20	15,51	65	-7.082-	0.001
Disease duration (days)	11.12	4.29	10	14.79	3.94	14	-6.563-	**0.001**
Temprature ℃	38.20	0.60	38.1	38.35	0.49	38.2	-1.875-	0.061
Heart rate (beat/min)	70.34	4.88	71.0	70.15	7.11	71.00	-.870-	0.384

Respiratory rate	25.21	2.65	26.00	24.87	3.12	25.00	-1.238-	0.216
D-dimer µ/mL	0.69	0.55	0.50	0.70	0.48	0.50	-1.044-	0.296
Prothrombin time	12.38	0.68	12.10	13.03	1.24	12.60	-5.440-	**0.001**
Prothrombin conc	96.82	5.53	99.00	92.35	9.13	96.00	-5.223-	**0.001**
INR	1.06	0.100	1.00	1.15	0.16	1.10	-5.286-	**0.001**
Hemoglobin (g/dl)	13.04	2.68	13.30	11.91	2.64	11.70	-2.883-	**0.004**
RBCs	4.57	0.92	4.60	4.17	0.93	4.20	-3.120-	**0.002**
HCT	38.76	7.81	38.9	35.19	7.61	35.60	-3.150-	**0.002**
RDW	15.55	6.76	13.60	15.19	5.47	13.60	-0.103-	0.918
Platelets count × 10^3	281.318	103.275	274.000	278.772	126.276	251.000	-0.188-	0.851
MPV	8.72	1.44	8.40	8.70	1.77	8.80	-0.125-	0.900
WBCs × 10^3	10.281	6.223	8.100	10.462	7.226	8.900	-0.882-	0.378
Neutrophil absolute count	7.747	6.903	4.900	7.475	7.205	5.600	-0.343-	0.732
Lymph absolute count	2.033	1.448	1.880	2.139	1.801	1.790	-.023-	0.982
Mono absluote count	0.767	0.418	0.680	0.729	0.464	0.630	-1.080-	0.280
CRP mg/l	14.87	18.59	6.00	16.87	19.23	6.00	-1.109-	0.267

We found an insignificant correlation between the radiological findings and gender, RT-PCR, or rapid antigen test findings. (**Table .3).** All of the studied cases were assessed using both RT-PCR and rapid antigen findings. In the RT-PCR, 57(30.6%) cases were positive and 129(69.35%) cases were negative. Meanwhile, in rapid antigen tests, 48(25.81%) cases were positive and 138(74.19%)cases were negative**. (Table .4).**

Table 3. Correlation between radiological findings and gender, RT-PCR, and rapid antigen test results

Variables		**Radiological findings**				**Chi-Square Test**	
		Normal (no=85)		**Abnormal (no=101)**		**Test value**	**P-value**
		No.	**%**	**No.**	**%**		
Gender	**Male**	37	43.53%	50	49.50%	0.144	0.704
	Female	48	56.47%	51	50.50%		
PCR findings	**Negative**	54	63.53%	85	84.16%	1.835	0.176
	Positive	31	36.47%	26	25.74%		
Rapid antigen	**Negative**	59	69.41%	88	87.13%	1.425	0.233
	Positive	26	30.59%	23	22.77%		

Table 4. RT-PCR and rapid antigen test results of the studied cases

Variables	**Studied cases (N= 186)**	
	N	**%**
RT-PCR Negative	129	69.35%
RT-PCR Positive	57	30.65%
Rapid antigen test Negative	138	74.19%
R apid antigen test Positive	48	25.81%

There the results of Real-time PCR were highly significantly correlated with the results of the rapid antigen test. (**Table .5**). Compared to the RT-PCR assay, the SARS-CoV-2 rapid antigen tests to identify COVID-19 have a sensitivity of 85% (95% CI= 73.43% - 92.90 %), and specificity of 98.54% (95% CI= 94.83% - 99.82%), the PPV is 96.23% (95% CI= 86.52% - 99.02%), NPV is 93.75% (95% CI= 89.14% - 96.48%), and accuracy of 94.42% (95% CI= 90.23% - 97.18%),

and the area under the curve of 0.918. (**Table .6, Fig.2**).

Table 5. Relation between RT-PCR and rapid antigen results in the detection of COVID-19

Rapid antigen	Real-time PCR						
	Negative		Positive		Total	Test value	P-value
	No.	%	No.	%			
Negative	128	93.43%	9	6.57%	137	148.1	**<0.001**
Positive	1	2.04%	48	97.96%	49		
Total	129	69.35%	57	30.65	186 (100%)		

Table 6. Performance of rapid antigen test in the detection of Covid-19

Variables	Value	95% CI
Sensitivity	85.00%	73.43% - 92.90%
Specificity	98.54%	94.83% - 99.82%
Positive Predictive Value	96.23%	86.52% - 99.02%
Negative Predictive Value	93.75%	89.14% - 96.48%
Accuracy	94.42%	90.23% - 97.18%

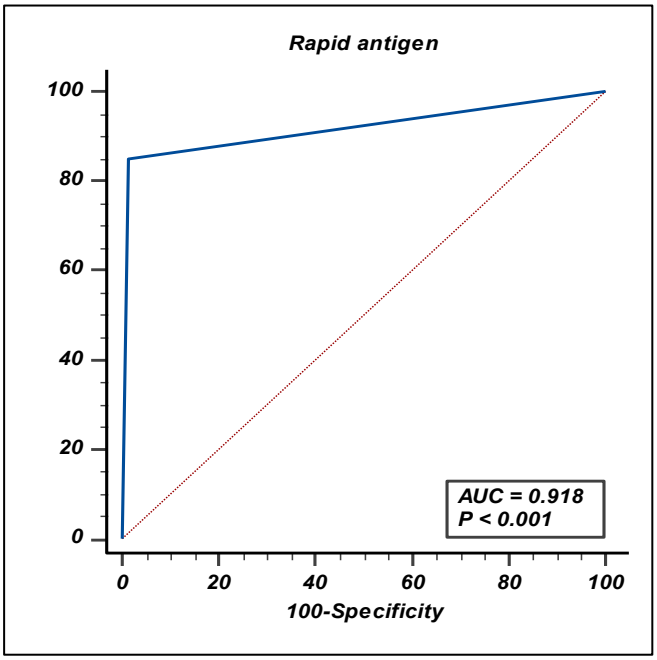

Fig.2. ROC curve of Rapid antigen test in the detection of Covid 19

When investigating the cases with discordant results between the rapid COVID-19 Antigen test and RT-PCR assay. Out of those 10 cases, there were 4 males and 6 females, their mean age was 48.3± 21.6 years and the mean duration of disease was 16.9± 6.4 days. Four of them showed a GGO on X-ray and one case has pneumonia, 9 cases were false negative, and one case was a false positive. (**Table .7).**

Table 7. Cases with discordant results between the rapid COVID-19 Antigen test and RT-PCR assay

No	Gender	Age	disease duration	Radiology findings	temp	heart rate	respiratory rate	PCR findings	Rapid antigen	D-dimer	CRP
1	**Male**	27	7	Normal	37.2	61	22	Positive	Negative	0.7	6
2	**Female**	34	22	Normal	37.8	76	29	Positive	Negative	0.5	6
3	**Male**	50	25	Normal	38.7	81	31	Positive	Negative	1.1	24
4	**Male**	80	26	G.G.Opacity	38.1	88	31	Positive	Negative	0.9	6
5	**Female**	25	13	G.G.Opacity	38	66	24	Positive	Negative	0.6	6
6	**Female**	66	19	Pneumonia	38.1	61	23	Positive	Negative	1.8	6
7	**Female**	26	12	Normal	39	74	26	Positive	Negative	1.1	24
8	**Female**	70	19	G.G.Opacity	38.7	61	21	Positive	Negative	1.1	6
9	**Male**	34	10	Normal	39.1	71	25	Positive	Negative	1.1	24
10	**Female**	71	16	G.G.Opacity	38.1	62	23	Negative	Positive	1.1	6

Discussion

For individualized patient treatment and hospital infection control, the quick and accurate diagnosis of the SARS-CoV-2 coronavirus is crucial **(Bornemann et al., 2022).** However, laboratory alterations seen in COVID-19 are related to disease severity and may not be specific to pathogenic mechanisms distinct from COVID-19 **(Tjendra et al., 2020).**

The current gold standard for diagnosing SARS-CoV-2 infection is RT-PCR, although it is limited by its long turnaround time and dependence on reagents and equipment, also known to have a variation in false-negative rate with time since exposure **(Kucirka et al., 2020).** Besides, its use is restricted in remote and/or resource-limited situations since skilled laboratory staff is required. However, the rapid antigen test is rapid, inexpensive, simple tests, and easy to perform **(Smith et al., 2021).**

According to the WHO (2021b the majority of COVID-19 patients develop mild (40%) or moderate (40%) illness, with approximately 15% developing severe disease requiring oxygen assistance and 5% developing critical conditions with complications. Pre-existing comorbidities (such as diabetes, hypertension, obesity, chronic lung disease, cancer, and cardiovascular illnesses), age >65, current smoking, ethnicity, and genetic susceptibility have all been found as risk factors for disease severity and mortality **(Alqahtani et l., 2020; Cho et al., 2021; WHO, 2021).**

In the current study, all cases were of mild or moderate severity, with a mean age of 52.55 ± 20.15 years. There were 88(47.3%) males and 98 (52.7%) females. These results were in line with **Teima et al. (2022)** who evaluated 860 COVID-19 patients. Female patients made up 54.2% of the study population, with a mean age of 46.1± 11.8 years and a range of 17 to 81 years. Likewise, **Jian et al., 2020**, evaluated 80 COVID-19 cases, of which 41 (51.25%) patients were female, with a median age of 46.1 years (IQR, 30.7–61.5). We found that the disease duration ranged between 3-26 days with a mean duration of 13.0± 4.43 days. The mean temperature at presentation was 38.29 ± 0.55 °C and ranged from 37 °C to 39.4 °C. This was identical to **Huang et al., 2020,** who reported that up to 94.1% of patients had fever on admission or during hospitalization and that 38.61 ± 0.81 °C was the highest recorded temperature.

In the current study, we found 85(45.70%) of cases had no radiological abnormalities, 83(44.62%) cases had GGO, 13(6.99%) cases had pneumonia, 6(3.23%) cases had pleural effusion, 2(1.07%) cases had emphysema, 1(0.54%) cases had atelectasis, 1(0.54%) case had a pulmonary embolism, and 1(0.54%) case had lung fibrosis. These were in agreement with **Arentz et al., 2020** study, which found that 20 patients (95%) had an abnormal chest radiograph at admission, including bilateral reticular nodular opacities in 11 patients (52%) and GGO in 10 patients (48%). By 72 hours, 14 patients (67%) had signs of GGO, while 18 patients (86%) had bilateral reticular nodular opacities. Bilateral reticular nodular opacities (52.4%), GGO (47.6%), pleural effusion (28.6%), focal consolidation (19%), and peribronchial thickening were the most often seen radiographic findings.

Furthermore, in the Cao et al., 2020 study, the rates of chest CT scans revealing GGO in the overall, non-severe, and severe groups were, respectively, 63.3%, 60.7%, and 76.2%. In

addition, Young et al., 2020 reported that chest radiographs remained clear throughout the acute illness in 9 (50%) patients while being clear at presentation in 12 (67%) individuals. Bilateral diffuse airspace opacities were formed in three patients with originally normal chest radiograph findings; two of these patients had been febrile for more than a week.

In this study, all cases had normal laboratory findings in CBC, CRP, and D-dimer findings. This was in partial agreement with **Cao et al., 2020** reported that the WBC counts were in the normal range of overall patients, but in the severe group, the lymphocytes of overall patients decreased significantly ($P < 0.01$), and the CRP level increased markedly in all patients, but it in the severe group was significantly higher than that in the non-severe group ($P < 0.01$). Yet, **Jian et al. (2020)** reported leukopenia in 36 (45.00%) patients, lymphocytopenia in 26 (32.50%) patients, thrombocytopenia in 11 (13.75%) patients, high CRP in 62 (77.50%) patients, high ESR in 59 (73.75%) patients, increased D-dimer in 3 (3.75%) patient, and elevated procalcitonin level in1(1.25%) patient. This was consistent with the studies by **(Jiang et al., 2020; Christopher et al., 2021; Lippi et al., 2020; Yi Li et al., 2021)** which were based on the hospitalization of patients with severe COVID-19**.** In addition, other studies reported lower platelet counts in COVID-19 patients compared to non-covid cases. However, median platelet counts for patients with COVID-19 who followed a critical course were not significantly different from their non-COVID-1 **(Jiang et al., 2020; Lippi et al., 2020)**. Contrarily, **(Qu et al., 2020)** described that hospitalized patients with COVID-19 presenting with an elevated platelet count had worse outcomes, this increase was due to the inflammatory milieu, and a slight increase in platelet count in those critical patients.

In this study, RT-PCR revealed 57(30.6%) positive cases and 129(69.4%) negative cases, but the rapid antigen test revealed 49(26.34%) positive cases and 137(73.35%) negative cases. The ROC curve constructed demonstrated that the SARS-CoV-2 rapid antigen test's overall agreement with the RT-PCR results, gold standard, 85% sensitivity (95% CI, 73.43% - 92.90 %), and 98.54% specificity (95% CI, 94.83% - 99.82%), 96.23% PPV (95% CI, 86.52% - 99.02%), 93.75% NPV (95% CI= 89.14% - 96.48%), 94.42% accuracy (95% CI, 90.23% - 97.18%), and with 0.918 the area under the curve. This satisfied the WHO acceptance requirement when implementing the rapid antigen SARS-CoV-2 test with a sensitivity of ≥ 80% and specificity of ≥ 97% **(WHO, 2021c).**

Smith et al., 2021 also reported that the overall agreement between rapid antigen and RT-PCR results was 97.9%; sensitivity was 76.6% (95% CI= 71%–82%), and specificity was 99.7% (95% CI, 99%–100%). Also, they found no differences in performance between asymptomatic and symptomatic cases. By contrast, **Brihn et al. (2021)** reported that the clinical specificity of the Sofia Ag-RDT was excellent throughout. Moreover, they found that the overall agreement between rapid antigen and RT-PCR results was 97.9%; sensitivity was 76.6% (95% CI, 71%–82%), and specificity was 99.7% (95% CI, 99%–100%). Also, they found no differences in performance between asymptomatic and symptomatic individuals. A significantly short mean turnaround time for the antigen assay. In addition, no transmission from antigen-negative/RT-PCR–positive patients was identified

While Bornemann et al., 2022, reported that the Sofia Ag-RDT showed a clinical sensitivity of 62.9% (95% CI 57.8%-67.8%) and specificity of 99.4% (95% CI, 99.2%99.5%) among a total of 7877 patients presenting to the emergency department of a tertiary care hospital. It is interesting to note that a previous study evaluated the Sofia Ag-RDT and reported sensitivities ranging from 72% to 80% in symptomatic people **(Brihn et al., 2021).** In part, this might be explained by differences in sampling types (nasopharyngeal versus anterior nasal swabs).

Several studies **(Jääskeläinen et al., 2021; Prince-Guerra et al., 2021; Pray et al., 2021; Schuit et al., 2021; Strömer et al., 2021)** sought to evaluate the sensitivity of quick antigen testing in comparison to RT-PCR and cell culture. The use of fast antigen testing as a tool for identifying infectious patient samples has been suggested by all studies that found an increase in sensitivity when cell culture was the reference standard. On 18 samples that Sofia Ag-RDT deemed to be falsely negative, **Pray et al. (2021)** performed cell culture, yielding 2 virus isolations

In this study, when exploring the cases with conflicting results between the rapid Antigen test and RT-PCR assay. Out of those 10 cases, there were 4 males and 6 females, their mean age was 48.3± 21.6 years, and the mean duration of disease was 16.9± 6.4 days. Four of them showed a GGO on X-ray and one case has pneumonia, 9 cases were false negative, and one case was a false positive.

The use of Ag-RDTs in patients with symptoms associated with COVID-19 and re-testing asymptomatic but Ag-RDT-negative patients after one to two days are recommended by current guidelines **(Drain et al., 2022).**

This is consistent with the infection control measures, where the sensitivity of AG-RDT was higher in symptomatic compared to asymptomatic RT-PCR-positive patients. As a warning, false negative Ag-RDT results in a hospital setting are a concern as these patients might give rise to nosocomial transmissions. In these cases, the use of RT-PCR, and adherence to infection prevention measures are recommended until final confirmation **(Mockel et al., 2021).**

This study has several limitations, a small sample size of mild and moderate severity COVID-19, we did not perform cell culture due to a lack of resources to determine infectivity, This study evaluated patients from the chest department so test performance might differ in other test settings.

Conclusion

Although RT-PCR is still the gold standard for detecting SARS-CoV-2 infections, the rapid SARS-CoV-2 antigen test offers good sensitivity, specificity, PPV, NPV, and a significantly short turnaround time. As a result, it has great clinical utility as a primary frontline test for detecting infected patients in an emergency setting.

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