Egyptian Journal of Medical Microbiology Volume 32 / No.1 / January 2023 87-95 Online ISSN: 2537-0979

ORIGINAL ARTICLE

SARS-COV-2 antibody testing Versus Nasopharyngeal and Oropharyngeal swab Sample Polymerase Chain Reaction for Diagnosis of Coronavirus Disease 2019 (COVID-19) in Egyptian Patient. A Comparative study

[1]Fatma O. Khalil*, [1]Azza M. Abd El-Aziz, [2]Mohammad A. Ahmed, [2]Ahmed M. Abd-El Rahman, [1]Tawfik M. Abd El-Motaleb

[1]Clinical & Molecular Microbiology & Immunology Department, National Liver Institute, Menoufia University, Egypt
[2]Clinical Pathology Department, Medical Military Academy, Alexandria, Egypt

Key words:
COVID-19, Oropharyngeal and Nasopharyngeal swabs, PCR, Serological tests

Corresponding Author:
Fatma Omar Khalil
Microbiology & Immunology Department, National Liver Institute, Menoufia University-Menoufia, Egypt
Tel: 0020-01068097624
fatma.khalil@Liver.Menofia.edu.eg

ABSTRACT

Background: *SARS-CoV-2 identification via Real-time polymerase chain reaction (RT-PCR) testing considered the current standard for the diagnosis of infection, but its utilization for large-scale screening is limited. Serological immunoglobulin M (IgM)/IgG testing has been proposed as a useful tool for detecting SARS-CoV-2 exposure,* ***Objectives;*** *to assess the diagnostic value of SARS-COV-2 IgM and IgG in early diagnosis of patient with COVID-19 versus viral RNA detection by PCR and to Investigate the sensitivity of nasopharyngeal swabs versus oropharyngeal samples for early detection of SARS-COV-2.* ***Methodology:*** *This study was carried on 200 COVID-19 PCR positive cases divided into two groups as (Group I). In addition to 200 apparently healthy individuals (Negative PCR) as a control group (Group II) obtained From Ministry of Health Hospitals after getting approval. All patients were subjected to: clinical examination, lab investigation including; SARS-COV-2 IgM and IgG testing, SARS-COV-2 PCR test from nasopharyngeal and Oropharyngeal swabs samples,* ***Results****; Regarding IgM after 10 days, It was positive in 77 (38.5 %) of patients with Positive PCR while no one was positive in patients with negative PCR with sensitivity of 38.5 % , Specificity 100.0 %, and accuracy 69.25 %, Nasopharyngeal Swabs (NPS) had significantly higher SARS-CoV-2 detection rate, sensitivity, and viral load than Oropharyngeal Swabs. NPS could reduce droplets production during swabs.* ***Conclusion:*** *NPS should be recommended for diagnosing COVID-19 and monitoring SARS-CoV-2 load. Also, our study analyzed the clinical performance of the rapid serological test and confirmed the test's limited applicability for the diagnosis of SARS-CoV-2 infection.*

INTRODUCTION

The coronavirus (CoV) is an enveloped, single-stranded RNA virus belonging to the coronavirus subfamily. The CoVs genome is 26-32 kilobases in length, probably the largest known viral RNA[1]. SARS-CoV-2, along with his two strains from bats, are closely related to the genus Betacoronavirus in the subgenus Sarbecovirus (Lineage B). It is 96% identical to another bat coronavirus sample (BatCovRaTG13) at the genome-wide level[2]. The RNA genome consists of 29,891 nucleotides (GenBank #MN908947) and encodes 9860 amino acids in the order 5'UTR-replicase (orf1a/b)-spike (S)-envelope (E)-membrane (M)-nucleocapsid (N). The S, E, M, N-3'UTR (4) encodes the structural protein[3].

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). The disease was first identified in 2019 in Wuhan, the capital city of Wuhan, Hubei Province, China, and has since spread worldwide, leading to the ongoing coronavirus pandemic in 2019-2020[2].

Common symptoms are fever, cough, and shortness of breath. Other symptoms include muscle pain, phlegm production, diarrhea, sore throat, loss of smell, and abdominal pain. Most cases cause mild symptoms, but some progress to pneumonia and multiple organ failure making Rapid and accurate diagnosis is a must [3].

However, due to the low viral load in the samples, molecular detection carries the risk of false-negative results[4]. Another common laboratory test,

serology, can diagnose disease by detecting antibodies and is currently being evaluated[5].

Currently, the most effective control against 2019-nCoV is early detection and isolation of new sources of infection, and early detection and supportive care of confirmed cases. Our dream is to find a specific vaccine[6].

METHODOLOGY

This case control study was conducted on COVID-19 patients from Menoufia University Hospitals and Ministry of Health Hospitals. **The laboratory tests were done in** National Liver Institute, Menoufia University and Ministry of Health Hospitals. This study was conducted on adequate number of cases divided into two groups: Group I: COVID -19 PCR positive patients **and** Group II: COVID -19 PCR negative case as a control group from Ministry of Health Hospitals after getting approval from ethical committee of National Liver Institute- Menoufia University (IRB no.00359/2022).

Inclusion criteria:

Patients hospitalized with a SARS-cov-2 infection confirmed by real-time reverse transcription polymerase chain reaction method according to World Health Organization interim guidance (WHO, 2020), negative controls were obtained from suspected cases with flu like clinical symptoms, no history of contact with confirmed COVID-19 patients, and no history of antibody detection of a SARS-CoV-2 and patients who can provide informed consent.

Exclusion criteria:

Patients with infection of other pathogenic microorganisms like, HBV, HCV and HIV, pregnancy and declined informed consent.

All participants **underwent** the **following tests:**

- **Full history taking:** Age & sex and comorbidities (hypertension, diabetes, ischemic heart disease, atrial fibrillation, COPD, chronic kidney disease, chronic liver disease), symptoms of infection and medications taken.
- **Through clinical examination:** General examination: heart rate, blood pressure, temperature and respiratory rate and chest examination and auscultation.
- **Chest X-ray and CT scan**: All images were obtained with the patients in the supine position. All chest CT images were reviewed and classified as positive or negative CT findings by consensus with blinding to RT-PCR results.
- **Laboratory investigations**: CBC, urea, creatinine, liver function tests as SGOT, SGPT, serum ferritin, D dimer and CRP.
- **Clinical Specimens:** Respiratory specimens, primarily nasopharyngeal and throat swabs, were collected from all participants. Samples were mixed with 2 ml of the viral transport medium (VTM) consisting of Hank's balanced salt, 0.4% fetal bovine serum, HEPES, antibiotics and antimycotics. The samples were transported at 2–8°C to the National Liver Institute – Menoufia University Microbiology Laboratory, where they were processed within hours. All samples were processed in a Biosafety Level 3 (BSL-3) and Biosafety Level 2 Enhanced (BSL-2+) facility with full personal protective equipment.
- **Viral RNA Extraction**: SARS-CoV-2 RNA was extracted from 200 µl nasopharyngeal and throat swabs using an automated extraction platform MagLEAD 12gC (Precision System Science, Chiba, Japan). Extraction was performed in the Microbiological laboratory tests were done in National Liver Institute, Menoufia University according to the manufacturer's instructions. Viral RNA was eluted in 100 µl of buffer and used for RT-PCR assays.
- **SARS-CoV-2 RNA detection using real-time** RT-PCR: Allplex™ 2019-nCoV assay (Seegene, Korea), sarvecovirus envelope gene (E) and RNA-dependent RNA polymerase (RdRp) and nucleocapsid (N) SARS- The CoV-2 gene was used for SARS-CoV-2 RNA detection according to the manufacturer's instructions.
- **Rapid SARS-CoV-2 antigen detection assay**: Standard Q COVID-19 Ag Test (SD Biosensor®, North Chuncheon, and Republic of Korea) is a rapid chromatographic assay for the detection of the SARS-CoV-2 nucleocapsid (N) antigen. Immunoassay. in respiratory samples.
- **Administrative and Ethical Design:** Formal approval was obtained from Menoufia University School of Medicine. Institutional Research Board IRB approval (IRB no.00359/2022).

Statistical Analysis:

All data were collected, aggregated, and statistically analyzed using SPSS 24.0 for Windows (SPSS Inc., Chicago, IL, USA). We used the Shapiro Walk test to test the normality of the data. Qualitative data were presented as frequencies and relative percentages. Differences between qualitative variables were calculated using the chi-square test ($\chi 2$) and Fisher's exact test, as indicated. Quantitative data were expressed as mean±SD (standard deviation) for parametric and median values and as a range for nonparametric data

Differences between two groups of quantitative variables for parametric and nonparametric variables were calculated using independent t-tests and Mann-Whitney tests, respectively.

RESULTS

The present study was conducted during the period from July 2020 to December 2020 in The National Liver Institute, Menoufia University and Ministry of Health Hospitals. Demographic data were demonstrated in table. 1. 200 PCR positive cases (147 males and 53 females) their ages ranged from 10 years to 83 years (mean 32.57 ± 14.94 years old), in addition to 600 samples taken from 200 PCR negative cases (148 males and 52 females) their ages ranged from 18 years to 80 years (mean 33.53 ± 14.29 years old) that constituted the second group.

Two hundred patients ranged in age between 10.0 – 83.0 years with a mean age of 32.57 ± 14.94 years for Positive PCR group and two hundred patients ranged in age between 18.0 – 80.0 years with a mean age 33.53 ± 14.29 years for Negative PCR group. There was statistically non-significant difference between the two groups regarding to the mean of age. Positive PCR group had 147 males and 53 females, while Negative PCR group had 148 males and 52 females. There was statistically non-significant difference between gender distributions in the two groups.

Table 1: Comparison between the two studied groups according to demographic data

Demographic data	Positive PCR (n = 200)		Negative PCR (n = 200)		p
	No.	%	No.	%	
Gender Male Female	 147 53	 73.5 26.5	 148 52	 74.0 26.0	0.910
Marital status Single Married	 113 87	 56.5 43.5	 105 95	 52.5 47.5	0.422
Age (years) Min. – Max. Mean ± SD. Median (IQR)	 10.0 – 83.0 32.57 ± 14.94 27.0 (22.0 – 39.5)		 18.0 – 80.0 33.53 ± 14.29 28.0 (23.0 – 41.0)		0.514

χ^2: **Chi square test**,
t: Student t-test
p: p value for comparing between **positive** and **negative** PCR
SD: **Standard deviation,**
IQR: **Inter quartile range**

In table 2; there was statistically a significant difference between the two groups according to Hemoglobin, WBCs ($x10^3$), platelet and lymphocytes. Positive PCR showed lower level than Negative PCR ($p<0.001^*$). Positive PCR showed higher Neutrophils than Negative PCR ($p<0.001^*$). Regarding O_2 saturation, there was statistically a significant difference between the two groups according to O_2 saturation. Positive PCR showed lower PLT than Negative PCR ($p<0.001^*$).

Table 2: Comparison between the two studied groups according to laboratory parameters

Laboratory parameters	Positive PCR (n = 200)	Negative PCR (n = 200)	U	P
Hemoglobin				
Min. – Max.	8.30 – 16.80	9.40 – 16.40		
Mean ± SD.	12.89 ± 1.34	13.59 ± 1.05	13524.5*	<0.001*
Median (IQR)	13.0 (11.80 – 13.95)	13.60 (12.8 – 14.45)		
WBCs ($x10^3$)				
Min. – Max.	1600.0 – 16000.0	1154.0 – 16820.0		
Mean ± SD.	4891.0 ± 1885.63	8298.53 ± 1880.92	1533.0*	<0.001*
Median (IQR)	4600.0 (3900 - 5500)	7997.50 (7150 – 9172)		
Lymphocytes				
Min. – Max.	7.0 – 43.0	40.0 – 71.0		
Mean ± SD.	20.04 ± 6.92	54.37 ± 7.47	32.0*	<0.001*
Median (IQR)	19.0 (16 - 22)	54.0 (49 - 60)		
Neutrophils				
Min. – Max.	50.0 – 88.0	20.0 – 55.0		
Mean ± SD.	73.99 ± 7.12	38.88 ± 7.17	16.50*	<0.001*
Median (IQR)	75.0 (71 - 79)	39.0 (33 – 44.5)		
PLT				
Min. – Max.	140.0 – 218.0	165.0 – 399.0		
Mean ± SD.	176.33 ± 23.33	271.67 ± 67.76	3489.0*	<0.001*
Median (IQR)	174.50 (155.5 - 197)	268.0 (208 - 332)		
O_2 saturation				
Min. – Max.	86.0 – 99.0	93.0 – 99.0		
Mean ± SD.	95.25 ± 2.53	97.14 ± 1.21	8616.5*	<0.001*
Median (IQR)	96.0 (95 - 97)	97.0 (96 - 98)		

U: **Mann Whitney test**
p: p value for comparing between **positive** and negative PCR
*: Statistically significant at $p \leq 0.05$
SD: **Standard deviation,** IQR: **Inter quartile range**

In table 3, distribution of the studied cases according to End result for IgM & IgG (n = 200 PCR positive cases). Negative IgM & IgG was found in 123 (61.5 %), Positive IgM only was found in 21 (10.5 %), Both IgM & IgG positive was found in 56 (28.0 %), Total Positive IgM was found in 77 (29.5 %).

Table 3: Distribution of the studied cases according to End result for IgM & IgG (n = 200 PCR positive cases)

End result for IgM & IgG	No.	%
Negative IgM & IgG	123	61.5
Positive IgM only	21	10.5
Positive IgG only	0	0.0
Both IgM & IgG positive	56	28.0
Total Positive IgM	77	29.5

Table 4 showed that comparison between Nasal and oral (n = 200). There was statistically a non- significant difference between the two groups according to Nasal and oral (p= 0. 268)

Table 4: Comparison between Nasal and oral (n = 200)

	Nasal		Oral		McN	p
	No.	%	No.	%		
Negative	16	8.0	24	12.0	1.225	0.268
Positive	184	92.0	176	88.0		

McN: McNemar test
p: p value for comparing between **nasal** and **oral**

Table 5 showed that comparison of positive Nasal and positive oral swaps samples (n = 200 positive PCR cases). Regarding Age (years), Fever, Hemoglobin, White Blood Cells (WBCs, Lymphocytes, Neutrophiles, PLT, CRP, ESR, Ferritin, D- dimer, LDH, SGOT, SGPT, Urea, Creatinine, Na, K, IL-6, PCT, IgM, IgG, O_2 saturation, CT chest, IgM after 10 days and IgG after 10 days, There was statistically a non- significant difference between positive Nasal and positive oral swabs.

Table 5: Comparison of positive Nasal and positive oral swaps samples (n = 200 positive PCR cases)

	Positive Nasal	Positive Oral	^{McN}p
Age (years)			
<30	111 / 121 (91.7%)	105 / 121 (86.8%)	**0.327**
30 - <45	43 / 47 (91.5%)	42 / 47 (89.4%)	**1.000**
45 – 60	14 / 14 (100%)	13 / 14 (92.9%)	**-**
>60	16 / 18 (88.9%)	16 / 18 (88.9%)	**1.000**
Fever			
36.5 – 37.2	12 /12 (100%)	10 /12 (83.3%)	**-**
>37.2 – 38.2	96 /106 (90.6%)	93 /106 (87.7%)	**0.678**
>38.2	76 /82 (92.7%)	73/82 (89%)	**0.607**
Hemoglobin			
<12	59 / 61 (96.7%)	52/61 (85.2%)	**0.065**
12 – 15	124 / 138(89.9%)	123 / 138 (89.1%)	**1.000**
>15	1/1 (100%)	1/1 (100%)	**-**
WBCs			
<4500	93 /99 (93.9%)	88/99 (88.9%)	**0.332**
4500 – 11000	87/96 (90.6%)	83/96 (86.5%)	**0.523**
>11000	4/5 (80%)	5/ 5(100%)	**-**
Lymph			
<20	107 /117 (91.5%)	103/117 (88%)	**0.541**
20 - <40	74/80(92.5%)	70/80 (87.5%)	**0.454**
≥40	3/3 (100%)	3/3 (100%)	**-**
Neutro			
<40	0 / 0 (0%)	0 / 0 (0%)	**-**
40 – 75	93/103 (90.3%)	92/103 (89.3%)	**1.000**
>75	91/97 (93.8%)	84/ 97(86.6%)	**0.167**
PLT			
<150	34/37 (91.9%)	34/37 (91.9%)	**1.000**
150 – 400	150/163 (92%)	142/163 (87.1%)	**0.229**
>400	0 / 0 (0%)	0 / 0 (0%)	**-**
CRP	162/174 (93.1%)	156/174 (89.7%)	**0.362**
ESR	135 /147 (91.8%)	131 /147 (89.1%)	**0.572**
Ferretin	23/30 (76.7%)	25/30 (83.3%)	**0.453**
D- dimer	29/31 (93.5%)	27/31 (87.1%)	**1.000**
LDH	16/19 (84.2%)	15/19 (78.9%)	**1.000**
SGOT	8/9 (88.9%)	8/9 (88.9%)	**1.000**
SGPT	3/3 (100%)	3/3 (100%)	**-**
Urea	4/4 (100%)	4/4 (100%)	**-**
Creatinine	6/6 (100%)	5/6 (83.3%)	**-**
Na	0 / 0 (0%)	0 / 0 (0%)	**-**
K	0 / 0 (0%)	0 / 0 (0%)	**-**
IL-6	10/10 (100%)	9/10 (90%)	**-**
PCT	0 / 0 (0%)	0 / 0 (0%)	**-**
IgM	0 / 0 (0%)	0 / 0 (0%)	**-**
IgG	0 / 0 (0%)	0 / 0 (0%)	**-**
O_2 saturation			
<95	107 /117 (91.5%)	105 / 117 (89.7%)	**0.832**
≥95	0 / 0 (0%)	0 / 0 (0%)	**-**
CT (>0)	138 / 153 (90.2%)	136 /153 (88.9%)	**0.860**
IgM after 10 days	71 / 77 (92.2%)	66 / 77 (85.7%)	**0.332**
IgG after 10 days	51 / 56 (91.1%)	48 / 56 (85.7%)	**0.581**

McN: McNemar test

p: p value for comparing between **positive Nasal** and **Oral swabs.**

Table 6 showed comparison of positive nasal and positive oral swaps samples (n = 200 positive PCR cases) regarding to cough, sneezing, flu, sore throat, headache, myalgia, bone ache, dyspnea, nausea, vomiting, anorexia, diarrhea, colic and comorbidities. there was statistically a non- significant difference between positive nasal and positive oral swabs.

Table 6: Comparison of positive Nasal and positive oral swaps samples (n = 200 positive PCR cases)

Risk factors	Positive Nasal	Positive Oral	^{McN}p
Cough	182 / 198 (91.9%)	175 / 198 (88.4%)	**0.337**
Sneezing	46 / 51 (90.2%)	46 / 51 (90.2%)	**1.000**
FLU	41 / 47 (87.2%)	39 / 47 (83%)	**0.791**
Sore throat	181 / 196 (92.3%)	173 / 196 (88.3%)	**0.256**
Headache	183 / 199 (92%)	176 / 199 (88.4%)	**0.337**
Myalgia	184 / 200 (92%)	176 / 199 (88.4%)	**0.268**
Bone ache	184 / 200 (92%)	176 / 199 (88.4%)	**0.268**
Dyspnea	26 /27 (96.3%)	22/27 (81.5%)	**0.219**
Nausea	45 / 47 (95.7%)	39 / 47 (83%)	**0.109**
Vomiting	13 / 14 (92.9%)	13 / 14 (92.9%)	**1.000**
Anorexia	79 / 86 (91.9%)	76 / 86 (88.4%)	**0.629**
Diarrhea	37 / 42 (88.1%)	38 / 42 (90.5%)	**1.000**
Colic	4/5 (80%)	5/5 (100%)	**-**
Comorbidities	24/ 27(88.9%)	26/27 (%)	**0.625**

McN: McNemar test

p: p value for comparing between **positive Nasal** and **Oral swabs.**

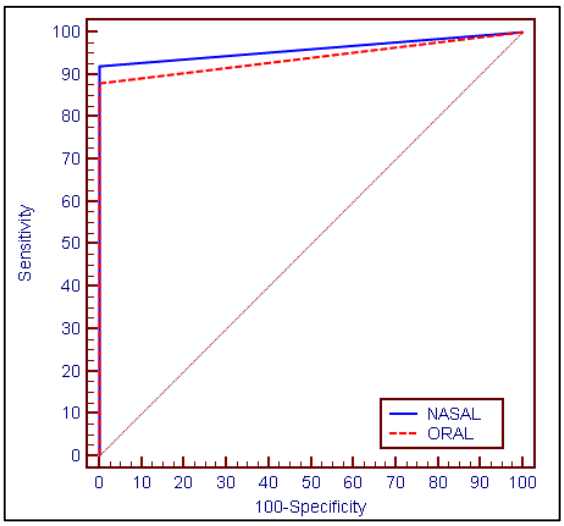

Fig. 1: ROC curve for nasal and oral swabs to discriminate Positive PCR cases (n=200) from negative PCR cases (n = 200)

Figure (1) shows ROC curve for nasal to discriminate Positive PCR from negative PCR cases: AUC of Nasal was 0.960* (p < 0.001) had a high ability to discriminate Positive PCR from negative PCR cases with Sensitivity 92.0 %. As well as Figure (1) also shows ROC curve for oral to discriminate Positive PCR from negative PCR cases: AUC of oral was 0.940* (p < 0.001) had a high ability to discriminate Positive PCR from negative PCR cases with Sensitivity 88.0 %.

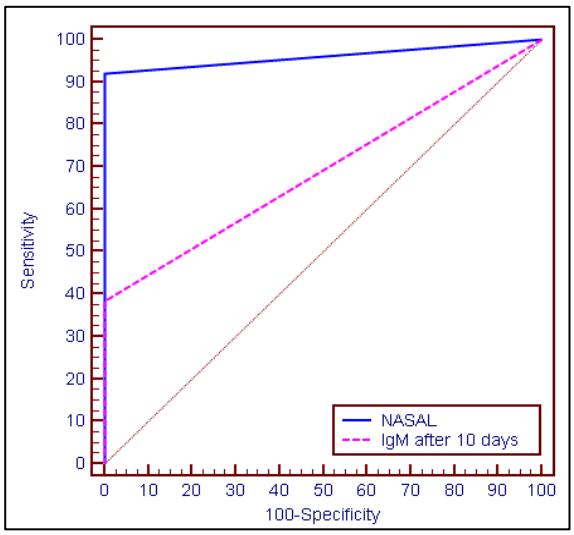

Fig. 2: ROC curve for nasal swab and IgM after 10 days to discriminate Positive PCR cases (n =200) from negative PCR cases (n = 200)

Figure 2 shows roc curve for nasal to discriminate positive PCR from negative PCR cases: AUC of nasal swab was 0.960* (p < 0.001) had a high ability to discriminate Positive PCR from negative PCR cases with sensitivity 92.0 %. As well as figure 2 also shows ROC curve for **IgM after 10 days** to discriminate positive PCR from negative PCR cases: AUC of **IgM after 10 days** was 0.693* (p < 0.001) had nearly

acceptable ability to discriminate positive PCR from negative PCR cases with sensitivity 38.5 %.

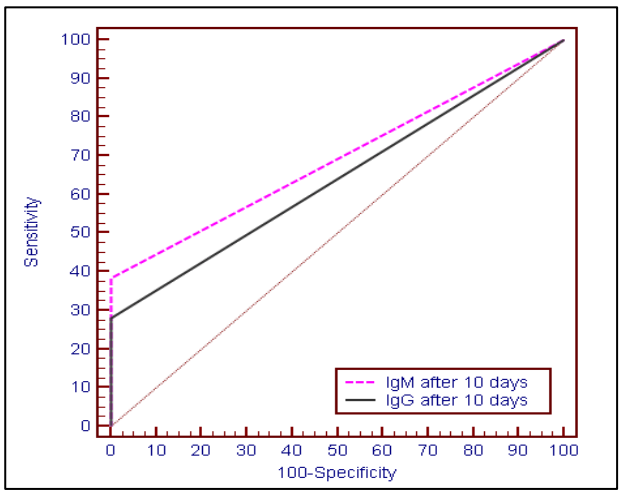

Fig. 3: ROC curve for IgM and IgG after 10 days to discriminate Positive PCR cases (n = 200) from negative PCR cases (n = 200)

Figure 3 also shows ROC curve for **IgM after 10 days** to discriminate Positive PCR from negative PCR cases: AUC of **IgM after 10 days** was 0.693* (p < 0.001) had nearly acceptable ability to discriminate Positive PCR from negative PCR cases with Sensitivity 38.5 %. As well as Figure (3) also shows ROC curve for **IgG after 10 days** to discriminate Positive PCR from negative PCR cases: AUC of **IgG after 10 days** was 0.640* (p < 0.001) had nearly acceptable ability to discriminate Positive PCR from negative PCR cases with Sensitivity 28.0 %.

DISCUSSION

The present study showed that 200 patients age range (10.0-83.0) years were found in the positive PCR group with a mean age of 32.57±14.94 years and 200 patients age range (18.0-80.0) years with a mean age of 33.53±14.29 years. For the negative PCR group. There was no statistically significant difference in mean age between the two groups. There were 147 males and 53 females in the PCR-positive group, and 148 males and 52 females in the PCR-negative group. There was a statistically non-significant difference in the gender distribution of the two groups. This results agreed with authors[7-9] , who found that no difference between patients with COVID-19 disease and controls with respect to age and gender distribution.

In our study, positive PCR showed significantly higher neutrophils count than negative PCR (p<0.001), and positive PCR showed lower level of O2 saturation, PLTs, lymphocytes, leukocytes counts, and hemoglobin concentration than negative PCR (p<0.001). This agreed with El Adli et al.[7] and Ahmed et al.[11] Analysis of hematological parameters showed a significant difference (P-value < 0.05) between COVID-19 infected and uninfected patients, indicating that lymphocytes were significantly different in the presence of COVID-19 infection. It turns out that the sphere decreases. Non-significant (p. Values >0.05) differences in hemoglobin (Hb percent), red blood cells (RBC), total white blood cell count (WBC), basophils, neutrophils, monocytes and eosinophils, and platelets (PLTS). Mohammed et al.[8] reported that patients with COVID-19 disease showed significantly higher numbers of leukocytes, neutrophils, lymphocytes, monocytes, and CRP than negative PCR (p<0.001).

The present study revealed a statistically significant difference between the two groups in Ferritin level. Positive PCR showed a higher Positive Ferritin than Negative PCR (p<0.001*).

Regarding D- dimer, there was statistically a significant difference between the two groups according to D- dimer, D- dimer and LDH. Positive PCR showed a higher level than Negative PCR (p<0.001*). Similarly, El Adri et al.[7] found that biochemical study on lactic dehydrogenase (LDH) and Ferritin showed significant difference in LDH and ferritin (P. value < 0.05), as these cells increased in the event of infection with COVID-19 a comparison between infected and non-infected with COVID-19. Also, there was a highly significant increase in C - reactive protein, (P. value < 0.002) in PCR positive cases as these cells increased in the event of infection with COVID-19. Also, Ahmed et al.[11] found comparable results and Mohamed et al.[8] found that D-dimer, LDH, and CRP were significantly higher in patients with COVID-19 disease.

The current study showed that Positive PCR cases had a higher Positive IL-6 than Negative PCR (p<0.001). Similar results were obtained by Mohamed et al.[8] who found significant elevated Interleukin-6 serum levels in patients with COVID-19 disease

In present study, we found non-statistically significant difference between the two groups according to Nasal and oral samples (p= 0. 268). These findings are matched with a study by the German Wölfel et al.[12] and Patel et al.[13] who found comparable results between patients with specimens collected early in the illness course, diagnostic results of SARS-CoV-2.

The current study showed that as regard nasal swabs were positive in 184 (92.0 %) of patients with Positive PCR while no one was positive with Negative PCR with sensitivity of 92.0 %, Specificity 100.0 %, and accuracy 96.0 %. Comparable results were obtained by Clerici et al.[14] and Chai Mayo et al.[15]. While Putty et al.[13] specificity was 97.6% (CI, 93.9%–99.5%) and was sensitivity of 81.8% (CI, 59.7%–94.8%), and Lee et al.[16] found limited agreement with our results

CONCLUSIONS

We concluded that Nasopharyngeal swabs were significantly higher SARS-CoV-2 detection rate, sensitivity, and viral load than oropharyngeal swabs. NPS can reduce droplet generation during swabs. NPS should be recommended for diagnosing COVID-19 and monitoring SARS-CoV-2 burden. Furthermore, our study analyzes the clinical performance of a rapid serological test and compares its performance with that of a standard molecular test to explore the application of this rapid test for the diagnosis of SARS-CoV-2 infection. I've verified that the range is limited. But this rapid serological test appears to provide important information about a person's immune response to infection and, more importantly, can detect previous exposure to the virus in currently healthy people.

Our study suffered from the usual limitations of the small sample. The relatively small number of patients in our study limited the statistical power of the analysis, so further studies with larger sample size is needed to establish our results.

This manuscript has not been previously published and is not under consideration in the same or substantially similar form in any other reviewed media. I have contributed sufficiently to the project to be included as author. To the best of my knowledge, no conflict of interest, financial or others exist. All authors have participated in the concept and design, analysis, and interpretation of data, drafting and revising of the manuscript, and that they have approved the manuscript as submitted.

REFERENCES

1. Han, Q, Lin, Q, Jin, S, You, L: Coronavirus 2019-nCoV: A brief perspective from the front line. *J Infect* 2020; 80, 373-377.
2. Hui, DS, Madani, TA, Ntoumi, F, Kock, R, Dar, O, Ippolito, G, et al.: The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health - The latest 2019 novel coronavirus outbreak in Wuhan, China. *Int J Infect Dis* 2020; 91, 264-266.
3. van Doremalen, N, Bushmaker, T, Morris, DH, Holbrook, MG, Gamble, A, Williamson, BN, et al.: Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *N Engl J Med*. 2020,8,4-7.
4. Chan, JF, Kok, KH, Zhu, Z, Chu, H, To, KK, Yuan, S, et al.: Genomic characterization of the 2019 novel human-pathogenic coronavirus isolated from a patient with atypical pneumonia after visiting Wuhan. *Emerg Microbes Infect* 2020; 9, 221-236.
5. Huang, WH, Teng, LC, Yeh, TK, Chen, YJ, Lo, WJ, Wu, MJ, et al.: 2019 novel coronavirus disease (COVID-19) in Taiwan: Reports of two cases from Wuhan, China. *J Microbiol Immunol Infect*, 2020; 1-3.
6. Pang, J, Wang, MX, Ang, IYH, Tan, SHX, Lewis, RF, Chen, JI, et al.: Potential Rapid Diagnostics, Vaccine and Therapeutics for 2019 Novel Coronavirus (2019-nCoV): A Systematic Review. *J Clin Med* 2020; 9.101-105.
7. El-Adly AM, Wardany AA, Shikhoun MH. Biochemical changes in Egyptian patients infected with COVID-19. Journal of Bioscience and Applied Research, 2022, 143-153.
8. Mohamed AA, Salem AA, Omran D, Shousha HI, Eysa B, Ghaffar MM et al. Diagnostic Role of Laboratory Markers in Egyptian Patients with Mild Coronavirus Disease-2019: A Case-Control Study. Biomedical Journal of Scientific & Technical Research, 2021; 35(3), 27754-27759.
9. Zhao J, Yang Y, Huang H, Li D, Gu D, Lu X et al. Relationship between the ABO blood group and the coronavirus disease 2019 (COVID-19) susceptibility. Clinical Infectious Diseases, 2021; 73(2), 328-331.
10. Samra, S., Habeb, M., & Nafae, R: ABO groups can play a role in susceptibility and severity of COVID-19. The Egyptian Journal of Bronchology, (2021); 15(1), 1-5.
11. Ahmed MM, Sayed AM, El Abd D, El Sayed IT, Elkholy YS, Fares AH et al. Diagnosis of coronavirus disease 2019 and the potential role of deep learning: insights from the experience of Cairo University Hospitals. Journal of International Medical Research, 2022, 50(7), 03000605221109392.
12. Wölfel R, Corman VM, Guggemos W, Seilmaier M, Zange S, Müller MA et al. Virological assessment of hospitalized patients with COVID-2019. Nature, 2020, 581(7809), 465-469.
13. Patel, M. R., Carroll, D., Ussery, E., Whitham, H., Elkins, C. A., Noble-Wang, J., et al.: Performance of oropharyngeal swab testing compared with nasopharyngeal swab testing for diagnosis of coronavirus disease 2019—United States, January 2020–February 2020. Clinical Infectious Diseases, (2021), 72(3), 482-485.
14. Clerici B, Muscatello A, Bai F, Pavanello D, Orlandi M, Marchetti GC et al. Sensitivity of SARS-CoV-2 detection with nasopharyngeal swabs. Frontiers in Public Health, 2021, 8, 593491.

15. Chaimayo C, Kaewnaphan B, Tanlieng N, Athipanyasilp N, Sirijatuphat R, Chayakulkeeree M, et al. Rapid SARS-CoV-2 antigen detection assay in comparison with real-time RT-PCR assay for laboratory diagnosis of COVID-19 in Thailand. Virology journal, 2020, 17(1), 1-7.

16. Lee RA, Herigon JC, Benedetti A, Pollock NR, Denkinger CM. Performance of saliva, oropharyngeal swabs, and nasal swabs for SARS-CoV-2 molecular detection: a systematic review and meta-analysis. Journal of clinical microbiology, 2021, 59(5), e02881-20.