Proceedings of The International Conference on Health Technology (ICoHT)
Volume 1, 2022
ISSN 2986-917X

COMPARISON OF IMMUNOGLOBULIN M IMMUNOGLOBULIN G ANTIBODY DETECTION AND SEVERE ACUTE RESPIRATORY SYNDROME CORONAVIRUS 2 ANTIGEN DETECTION

dr. Angle Maria Hasthee Sorisi, MSc, SpParK[1]
Dr. dr. Greta Jane Pauline Wahongan, M.Kes,SpParK[2]
Prof.Dr.dr. Josef Sem Berth Tuda, MKes, SpParK(K)[3]
[1,2,3]Faculty of Medicine, Sam Ratulangi University, Kleak Street, Manado, 95115

ABSTRACT

COVID-19 disease is a disease caused by infection with SARS-CoV-2. COVID-19 is currently a disease that attacks not only in one country but also attacks all countries in the world. Various methods have been used by governments in all countries to detect and treat this disease. The rapid test for IgM and IgG antibodies using the principle of immunochromatography is considered easier to do than other tests and can be used as an initial suspicion of SARS-CoV-2 infection. Recently, the rapid test for SARS-CoV-2 antigen has also developed. This study aims to compare the detection of IgM and IgG anti-SARS-CoV-2 antibodies and the detection of SARS-CoV-2 antigen in patients at hospitals in North Sulawesi. The specific target is to obtain data on the detection of anti-SARS-CoV-2 IgM and IgG antibodies and the detection of SARS-CoV-2 antigen in patients in hospitals. The type of research used was descriptive research with a cross-sectional research design which was carried out at Budi Mulia Bitung Hospital and Boroko Bolmut Hospital. The data collection technique, namely antibody detection, was carried out by dripping the patient's serum on the antibody detection-based rapid diagnostic test kit and nasal swabs on the antigen detection-based rapid diagnostic test kit and interpreted according to the results obtained. The results of antigen detection examination in 232 patients if categorized by sex, males showed more reactive results, namely 7 patients (3%), while females were 6 patients (2.6%) of all patients examined. SARS Cov- 2. The results of antibody detection examinations in 50 patients if categorized by gender, women showed more reactive results, namely 7 patients, which was 14% of the total examined for anti-SARS Cov-2 antibodies. The results of this study are expected to provide input to related government agencies and to increase government awareness of the spread of COVID-19 in the community

Keywords: *COVID-19,IgM, IgG, Antigen SARS-CoV-2*

INTRODUCTION

COVID-19 disease is a disease caused by infection with SARS-CoV-2. COVID-19 is currently a disease that attacks not only in one country but also attacks all countries in the world. Due to the increasing spread of COVID-19 in various countries, WHO declared COVID-19 infection as a pandemic situation. Symptoms that arise as a result of SARS-CoV-2 infection can manifest as mild, moderate, severe, and even have no symptoms. Thus, preventing transmission by always following health protocols is very helpful in reducing the risk of transmission (1).

The rapid increase in the spread of the SARS-CoV-2 virus infection occurred in various countries, so that on January 30, 2020 WHO declared the COVID-19 outbreak a Public Health Emergency that Concerned the World (KMMMD). Until early September 2020, nearly 27 million cases of COVID-19 had occurred worldwide with the number of deaths reaching 900,000 people having been reported to WHO (2). Indonesia itself first reported two confirmed cases of COVID-19 on March 2 2020. On April 10 2020, all provinces in Indonesia were confirmed to have COVID-19 patients with a total of 3512 confirmed cases and 306 deaths (3).

Various methods have been used by governments in all countries to detect and treat this disease. Until now, an examination technique to confirm infection with the SARS-CoV-2 virus is recommended through molecular tests, for example Reverse Transcription-Polymerase Chain Reaction (RT-PCR). In this examination, the specimens used were taken from the upper respiratory

tract of suspected COVID-19 patients, namely the nasopharynx and oropharynx. Other examination techniques, namely rapid antibody tests (IgM and IgG) and antigen tests using the principle of immunochromatography are considered easier to do than other tests and can be used as an initial suspicion of SARS-CoV-2 infection (1,4).

The purpose of this study was to compare the detection of anti-SARS-CoV-2 antibodies (fIgM and IgG) and the detection of SARS-CoV-2 antigen in patients at a hospital in North Sulawesi. The specific target is to obtain data on the detection of anti-SARS-CoV-2 IgM and IgG antibodies and the detection of SARS-CoV-2 antigen in patients at Budi Mulia Bitung Hospital and Boroko Bolmut Hospital.

RESEARCH METHODS

The type of research used is descriptive research with a cross-sectional research design that will be carried out at Budi Mulia Bitung Hospital and Boroko Bolmut Hospital. The data collection technique was by detecting antibodies which was carried out by dripping the patient's serum on the antibody-detection-based rapid diagnostic test kit and nasal swabs on the antigen-detection-based rapid diagnostic test kit and interpreted according to the results obtained.

RESULT AND DISCUSSION

The results of the study on the detection of IgM and IgG anti-SARS-CoV-2 antibodies and antigens in patients at Budi Mulia Hospital in Bitung and Bolmut Hospital who were examined using an RDT kit based on antibody and antigen detection can be seen in Table 4.1 and Table 4.2.

Table 4.1. Results of Testing for SARS CoV-2 Antigen by Gender

No	Gender	Antigen SARS CoV-2				
		Checked	+	%	-	%
1	Male	140	7	3%	133	57.3%
2	Female	92	6	2.6%	86	37.1%
	Total	232	13	5.6%	219	94.4%

Source: Primary data,2020

The results of the examination of 232 patients were categorized by sex, males showed more reactive results, namely 7 patients (3%), while females were 6 patients (2.6%) of all patients examined for SARS Cov-2 Antigen.

Table 4.2. Examination Results for Anti-SARS CoV-2 Antibodies based on Gender

No	Gender	Antibodi (IgG/IgM) Anti SARS CoV-2				
		Checked	+	%	-	%
1	Male	21	4	8%	17	34%
2	Female	29	7	14%	22	44%
	Total	50	11	22%	39	78%

Source: Primary data,2020

Examination results on 50 patients if categorized by gender, women showed more reactive results, namely 7 patients, namely 14% of the total examined. Antibodies against SARS CoV-2.

Table 4.3 Comparison of Rapid Antibody Test and Antigen Rapid Test Methods

No	Parameter	Rapid test Antibody	Rapid Test Antigen
1	Method	Lateral flow assay (LFA)	Lateral flow assay (LFA)
2	detection	Antibodi (IgM, IgG) anti SARS-CoV-2	Antigen SARS-CoV-2
3	sample	Serum/plasma, whole blood	Swab nasofaring/orofaring
4	sample processing time	15 – 20 minute	15-20 minute
5	the ability of the tool to work on the sample	Detect one by one sample	Detect one by one sample
6	officer expertise	Does not require special skills (high)	Does not require special skills (high)
7	equipment and space requirements	Sample work does not require special tools and rooms, it can be done in the community service room	Sample work does not require special tools and rooms, it can be done in the community service room

Source: Primary data,2020

Examination of rapid test Antibodies, serum examined using the immunochromatographic method. Serum is dripped onto the sample pad of the test strip. Antibodies present in blood serum will bind to recombinant antigens present on the test strip to form antigen-antibody complexes. The antigen-antibody complex will bind to the anti-human antibody in the indicator area of the test strip so that it produces a color on the indicator and is interpreted according to the results obtained (5). Antibodies in the body are glycoproteins that will specifically bind to foreign antigens or microorganisms that enter the body (6). IgM is known to provide a primary immune response, which is the first antibody formed as an initial response. from an infection. Meanwhile, IgG is known as a secondary immune response, which is an antibody that provides long-term immunity after an infection (7).

After infection with the SARS-CoV-2 virus, antibodies will be formed by the body a few days or weeks afterward. The body's response in producing antibodies after a viral infection depends on several factors, such as age, nutritional status, severity, and certain medications or infections such as HIV which can weaken the immune system (2). Examination by the immunochromatography method or lateral flow is known more it is easy to do when compared to testing for COVID-19 with other methods so that it can be used in various situations. Medical personnel more often use examinations using this method to make a presumptive diagnosis or initial suspicion of a recent SARS-CoV-2 infection if the results of a molecular examination show negative results but there is a strong epidemiological link to SARS-CoV-2 infection in the person concerned (2). Interpretation of the examination with the results of reactive antibodies (+) can provide information that the subject's immune system has formed IgM and IgG antibodies against the SARS-CoV-2 recombinant antigen present in the antibody detection RDT. Likewise with the interpretation of the antigen (+) examination on the antigen detection RDT, it can provide information that the subject has been exposed to the SARS CoV-2 virus. The individual/patient concerned is required to carry out independent isolation/treatment, as well as carry out further examinations in the form of molecular examinations to confirm COVID-19 infection. Meanwhile, reactive IgG results provide information that the subject's immune system has formed IgG

antibodies and there is a possibility that the sample has been infected for several weeks (5). In samples with reactive IgG results, it is suspected that the subject's immune system has formed IgG antibodies and it is suspected infection that lasts for several weeks. Interpretation of the examination with reactive IgM and IgG results can provide information that the subject's immune system has formed IgM and IgG antibodies against the recombinant viral antigen present on the antibody detection RDT.

Overall, the results of naso/oropharyngeal swab examination in 232 patients using the immunochromatography method for antigen detection showed that 13 (5.6%) of the samples examined showed reactive (+) results and the remaining 219 (93.4%) samples showed non-reactive results (-). While the antibody examination showed the results of examination of 50 patient sera using the immunochromatographic method for antibody detection, 11 samples examined (22%) showed reactive IgM / IgG results, and the remaining 39 samples (78%) showed non-reactive IgM / IgG results. Interpretation of the results on samples with reactive IgM/IgG antibodies indicated that the infection was suspected to have occurred for more than 14 days and the immune system of the two samples had been actively producing antibodies. Subjects with reactive IgM/IgG antigen and antibody interpretation are required to carry out self-isolation/treatment and are encouraged to carry out further tests to ensure whether the sample is a confirmed COVID-19 patient (5). Blood serum examination samples with reactive IgG results can provide information that the immune system has produced IgG antibodies against the virus recombinant antigen present in the RDT used. Samples with interpretation of reactive IgG results are suspected to have been infected for several weeks (5). Samples with non-reactive IgM and IgG results can provide information if antibodies are not and or have not been produced and the subject is suspected not to be infected with COVID-19. If IgM and IgG are non-reactive while the subject has symptoms like COVID-19, it is suspected that these symptoms are an infection that resembles COVID-19 (5).

Research conducted by Imai et al in February - March 2020 in Japan regarding clinical evaluation of examinations Antibodies using the immunochromatographic method show different results depending on the onset of the disease and whether there are symptoms of SARS-CoV-2 infection in confirmed COVID-19 patients. Examinations carried out on 35 asymptomatic patients with sampling less than one week after confirmed COVID-19 infection by PCR showed results 14 (40%) of them had reactive IgM results and all samples showed non-reactive IgG results. In addition, examination of three asymptomatic patients with sampling ranging from 1-2 weeks after confirmed COVID-19 infection showed that 1 (33.3%) of them had 37 reactive IgM results and none showed reactive IgG. Meanwhile, examination of 53 symptomatic patients with confirmed COVID-19 with sampling less than one week after the onset of illness gave 17% (9/53) results showing reactive IgM and 3.8% reactive IgG (2/53). Examination of patients with disease onset 1-2 weeks showed that 33.3% (4/12) gave reactive IgM results and 8.3% of people (1/12) showed reactive IgG results. Examinations conducted on confirmed COVID-19 patients with disease onset of more than two weeks showed 100% (9/9) gave reactive IgM results and 44.4% (4/9) showed reactive IgG results. Meanwhile, patients who detected IgG antibodies also detected IgM antibodies (7).

Research conducted by Zhao et al in January - February 2020 in China regarding the antibody response to SARS-CoV-2 in confirmed COVID-19 patients -19 shows seroconservation of IgM and IgG. IgM begins to appear in the first week and shows an increase in the second week after the onset of the disease. Meanwhile, IgG seroconservation began to increase on days 13-15 after the onset of the disease. In the same study, examination on days 1-7 after the onset of the

disease showed an IgM sensitivity of 28.7%, an IgG sensitivity of 19.1%, a total antibody sensitivity of 38.3%. At 8-14 after the onset of the disease showed an increase in the sensitivity values of IgM, IgG and total antibodies, namely 73.3%, 54.1% and 89.6%. On days 15-39 after the onset of the disease showed a significant increase in the sensitivity of IgM, IgG and total antibody, namely 79.8%, 94.3% and 100%. In contrast to the diagnosis using testing for antigen RNA with samples from the respiratory tract, there was a decrease in sensitivity on days 1-7, 8-14, and days 15-39, namely 66.7%, 54% and 45.5%. Meanwhile, the combined use of RNA antigen examination and antibody examination showed a better increase in the sensitivity of the diagnosis, namely days 1-7 of 78.7%, days 8-14 of 97%, and days 15-39 of 100% (9).

Interpretation of antibody test results depends on several factors including the duration of infection, clinical morbidity, testing tools, and the reliability of the results obtained. with severe symptoms compared with individuals with mild symptoms or no symptoms.[2] This is in accordance with a study conducted in China in January 2020 – February 2020 where there was a strong positive correlation between disease severity and antibody titers two weeks after disease onset (9).

CONCLUSIONS

Immunoglobulin M and Immunoglobulin G anti-SARS-CoV-2 antibodies and SARS-CoV-2 antigen were detected in patients at Budi Mulia Bitung Hospital and Boroko Bolmut Hospital. The RDT test for anti-SARS-CoV-2 antibodies was detected positive in 22% of 50 patients and the RDT test for SARS-CoV-2 antigen was detected positive in 5.6% of 232 patients. The next suggestion is to check for SARS CoV-2 infection using the PCR method.

REFERENCES

1. KEMENKES RI..Pedoman Pencegahan dan Pengendalian Coronavirus Disease (COVID- 19) [Internet]. Aziza L, Aqmarina A, Ihsan M, editor. Kementerian Kesehatan RI; 2020 Available from: https://covid19.kemkes.go.id/protokol-covid-19/kmk-no-hk-01-07-menkes-413-2020-ttg-pedoman-pencegahan-dan-pengendalian-covid-19/#.X0bvO- gzbIW.
2. World Health Organization(WHO). Diagnostic Testing for SARS-CoV-2 [Internet]. 2020. Available from: https://www.who.int/publications/i/item/diagnostic-testing-for-sars-cov-2.
3. Gugus Tugas Percepatan Penanganan COVID-19. Infografis COVID-19 (10 April 2020) - Berita Terkini _ [Internet] Available from: https://covid19.go.id/p/berita/infografis-covid-19-10-april-2020
4. Ahn DG, Shin HJ, Kim MH, Lee S, Kim HS, Myoung J, et al. Current Status of Epidemiology, Diagnosis, Therapeutics, and Vaccines for Novel Coronavirus Disease 2019 (COVID-19). J Microbiol Biotechnol [Internet].;30(3):313–24. 2020. Available from: https://pubmed.ncbi.nlm.nih.gov/32238757/
5. Jacofsky D, Jacofsky EM, Jacofsky M. Understanding Antibody Testing for COVID-19. J Arthroplasty [Internet].;35(7):S74–81. 2020. Available from: https://doi.org/10.1016/j.arth.2020.04.055
6. Peebles S, BA DM, BA VM..Antibodies- ClinicalKey. In: Immunology [Internet]. 9 ed. Elsevier Ltd; 2021 Available from: https://www.clinicalkey.com/#!/content/book/3-s2.0-B9780702078446000106.
7. Sewell W. C. Immunology and immunopathology. In: Underwood's Pathology [Internet]. 7 ed. Elsevier Ltd;. hal. 127–58. 2019. Available from: https://www.clinicalkey.com/#!/content/book/3-s2.0- B9780702072123000086.

8. Imai K, Tabata S, Ikeda M, Noguchi S, Kitagawa Y, Matuoka M, et al. Clinical evaluation of an immunochromatographic IgM/IgG antibody assay and chest computed tomography for the diagnosis of COVID-19. J Clin Virol [Internet]. 2020;128(April):104393. Available from: https://doi.org/10.1016/j.jcv.2020.104393 27.
9. Zhao J, Yuan Q, Wang H, Liu W, Liao X, Su Y, et al. Antibody responses to SARS-CoV-2 in patients of novel coronavirus disease 2019. Clin Infect Dis [Internet]. 2020; Available from: https://pubmed.ncbi.nlm.nih.gov/32221519