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Correlation Cycle Threshold Value in RT-PCR on the Results of Chest X-Rays of COVID-19 Patients

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ABSTRACT

COVID-19 is a virus that infects the respiratory system [1]. The gold standard for the diagnosis of COVID-19 is RT-PCR [2]. The severity of COVID-19 is seen from the cycle threshold value with strong positive, positive, and weak positive categories [3], then classified in the group of pneumonia or non-pneumonia.
this research aims to knowing the correlation of the Ct value to the results of a chest X-ray (pneumonia) and determining whether the Ct value can provide clinical information on COVID-19 patients.
The method used in this research is descriptive quantitative research type with a retrospective cross-sectional study on 189 confirmed samples of COVID-19, aged 18-35 years and conducting a chest X-ray examination when admitted to the COVID-19 Emergency Hospital Wisma Atlet Kemayoran in June to July 2021. Data analysis using logistic regression test on SPSS. The percentage of weak positive Ct value is 15.9%, positive Ct value is 19.6%, and strong positive Ct value is 64.6%. The percentage of chest x-ray results for pneumonia is 45%, and for non-pneumonia is 55%. Ct value has a correlation with pneumonia(chest X-ray) in COVID-19 patients with the most significant correlation being <29.

Keywords: *Cycle threshold value; RT-PCR; COVID-19; Chest X-ray; Pneumonia.*

INTRODUCTION

In December 2019, the number of pneumonia cases began to increase in Wuhan, China. Based on analytical studies by epidemiologists, the spread of the disease is linked to the South China Seafood Market, Wuhan[4]. The disease is called the 2019 novel coronavirus (2019-nCoV)[5]. Then in January 2020, it was changed to SARS-COV-2 by WHO, so the name of the disease became COVID-19[6].
COVID-19 is a zoonotic virus that can infect humans[6]. COVID-19 infects the respiratory system [1]. This virus also causes pneumonia (lung infection) [7].
Indonesia is a country affected by the COVID-19 pandemic. On March 2, 2020, the first confirmed patient of COVID-19 was announced[8]. After the COVID-19 outbreak, the Kemayoran Athlete's Wisma was made an Emergency Hospital for handling COVID-19 by the government on March 18, 2020 and can be used since March 23, 2020.
The World Health Organization (WHO) recommends RT-PCR (Reverse Transcription-Polymerase Chain Reaction) as the gold standard for detecting COVID-19[2]. RT-PCR was performed using mRNA (messenger RNA) as a template [9]. RT-PCR produces a threshold value (Cycle Threshold Value) or hereinafter referred to as the Ct value which refers to the number of cycles required to amplify viral RNA to reach a detectable level[10].
The Ct value correlates with the amount of viral nucleic acid in the sample and can be obtained from the RT-PCR assay used for the diagnosis of COVID-19 patients[11]**.** The Ct value is inversely proportional to the number of viruses, so the Ct value can indicate the level of viral replication activity that affects the infectivity of SAR-CoV-2 in patients[12].

The American College of Radiology recommends a chest X-ray as an early diagnosis for COVID-19[13], which can describe conditions in the lungs[4]. Chest X-rays are used for diagnosis in COVID-19 patients during the pandemic [14].

Chest X-rays are used as a method of observing chest radiographs in postero-anterior or antero-posterior projections. Chest X-rays can be used in the emergency setting as a quantitative method of rates of SARS-CoV-2 pneumonia, and are correlated with an increased risk of ICU admission[15]. The patient's clinical picture showed that a positive SARS-CoV-2 RT-PCR test result also showed an abnormal chest X-ray[16].

Based on observations at the Wisma Atlet Kemayoran COVID-19 Emergency Hospital, someone World Health Organization was confirmed to have COVID-19 with a different Ct value on RT-PCR also showed different chest X-ray results. Abnormal chest X-ray results showed pneumonia which can be used as a predictor of positive RT-PCR results[17].

The severity of COVID-19 can be seen from the Ct value on the RT-PCR with categories, namely strong positive (Ct value <29), positive (Ct value between 30-37), and weak positive (Ct value between 38-40) and then classified in the pneumonia or non-pneumonia group which can be seen from the results of the chest X-ray.

The purpose of this study was to determine the correlation of the Ct value (Cycle Threshold Value) in RT-PCR to pneumonia (seen on the results of a chest X-ray) in COVID-19 patients at the COVID-19 Emergency Hospital Wisma Atlet Kemayoran at the age of 18-35 years and determine Ct value can provide clinical information on COVID-19 patients.

METHOD

This type of research is quantitative descriptive with a retrospective cross-sectional study on 189 samples aged 18-35 years who performed radiological examinations, namely chest X-rays at the time of hospital admission a maximum of two days after confirmation of COVID-19 on RT-PCR. Data analysis using logistic regression test on SPSS.

The Ct value data was obtained from the RT-PCR results in the patient's medical record and the chest X-ray data obtained from the PACS system in Radiology which was then identified and verified manually.

The Ct value data were grouped into strong positive (Ct value <29), positive (Ct value between 30-37), and weakly positive (Ct value between 38-40) then classified in the pneumonia or non-pneumonia group as seen on the chest X-ray.

This research was conducted at the Wisma Atlet Kemayoran COVID-19 Emergency Hospital with samples taken from June to July 2021.

RESULTS AND DISCUSSION

The research data obtained based on secondary data from Medical Records and the PACS system at the Radiology Emergency Hospital COVID-19 Wisma Atlet Kemayoran in June and July 2021 are as follows:

Table 1: Ct value (*Cycle Threshold Value)*

Ct value	Frequency	Percent
Weak Positive (38-40)	30	15.9%
Positive (30-37)	37	19.6%
Strong Positive (<29)	122	64.6%
Amount	189	100.0%

Based on the calculation results, it is known that from 189 samples, the weak positive Ct value has a percentage of 15.9%, the positive Ct value has a percentage of 19.6%, and the strong positive Ct value has a percentage of 64.6%. This explains that most patients with a Ct value of less than 29 are in the strong positive category.

COVID-19 can be detected by RT-PCR test [18]. RT-PCR shows Ct value Pasculli *et al.*, 2021). A low Ct value is associated with a poor outcome so it is considered to predict the clinical course and prognosis in COVID-19 patients. Therefore, the Ct value can be used in making clinical decisions and management of COVID-19 patients[19].

Table 2: Thorax X-ray Results

X-ray Results	Frequency	Percent
Non Pneumonia	104	55,0%
Pneumonia	85	45,0%
amount	189	100,0%

Based on the table, it is known that the results of the chest X-ray examination of COVID-19 patients, of the 189 existing samples, the majority of the samples had a non-pneumonia chest X-ray, which was 55%, while the sample with a pneumonia thorax X-ray was 45%.

COVID-19 pneumonia causes the lung parenchyma to become inflamed. The inflammation is caused by SARS-CoV-2 [20]. The main problem with COVID-19 pneumonia is oxygenation[21]. A chest X-ray can describe the condition of the lungs in COVID-19 patients, so it is considered important to establish a diagnosis[4].

Table 3: Age

Usia	Frequency	%
18 - 26 Years	61	32,3%
27 - 35 Years	128	67,7%
amount	189	100,0%

Based on the table, from 189 existing samples, the sample with the age of 18-26 years has a percentage of 32.3%, while the sample with the age of 27-35 years has a percentage of 67.7%.

Table 4: Correlation Test

Cross Tabulation	*P*-value
Cycle Threshold with Pneumonia	0.000

Based on the table, it can be explained that the P value is less than 0.05 (P value <0.05), which means it is significant. Thus, it can be explained that there is a statistically significant correlation between the Cycle Threshold Value (Ct value) and pneumonia (thorax X-ray results) in COVID-19 patients.

This study shows that Ct values can be useful in providing clinical information to COVID-19 patients. Rabaan et al's research in 2021 also explained that the Ct value might be useful for health professionals and doctors in making the right decisions for COVID-19 patients[22].

Table 5: Percentage of Ct value against Pneumonia

Category Ct value	Odd Ratio	%
Positive	0.018	48.1%
Strong Positive	0.094	

The table above illustrates that the odds ratio for a positive Ct value is 0.018 times the probability of pneumonia occurring. Meanwhile, the odds ratio for the strong positive Ct value is 0.094 times the probability of pneumonia occurring. The percentage of correlation between Ct value and Pneumonia is 48.1%.

Among hospitalized patients, those with a Ct value <25 had a higher risk of more severe disease and death than patients with a Ct value of 30[11]. The Ct value represents value and can be used to predict and model epidemiological dynamics at the population level[23].

Ct value in COVID-19 was found to be an independent predictor of patient mortality. However, further studies are needed on how to best utilize such information clinically given the variation in results due to specimen quality, disease phase, and limited discriminatory ability of the test[24].

The COVID-19 pandemic has had an impact on the world[25]. The different study periods and the dynamics of COVID-19 at different sites may contribute to the heterogeneity in the reported data. Globally, hospitals also have different standards for hospitalization, especially at the start of the COVID-19 pandemic when many Hospitals accepted all patients with COVID-19 infection regardless of symptoms[11].

In several clinical studies consisting of small or large sample sizes, there were differences regarding the significant correlation between Ct values and disease severity in COVID-19[22].

Information about COVID-19 is still limited and epidemiological data will be very developed so that there may be changes in related matters according to research developments, progress of diagnosis and epidemiological data [26].

CONCLUSION

There is a statistically significant correlation between the Ct value and the results of a chest X-ray (Pneumonia) in COVID-19 patients with the most significant relationship, namely the Ct value with a strong positive category (<29).

Suggestion

In future research, it is possible to develop other variables that may have an effect, and it is necessary to conduct multi-center research and different time periods.

REFERENCES

[1] A. Fadli, “M ENGENAL C OVID -19 DAN C EGAH P ENYEBARANNYA D ENGAN ‘ P EDULI L INDUNGI ’ A PLIKASI B ERBASIS A NDORID,” no. April, pp. 1–6, 2020.

[2] A. S. Agustina and R. Fajrunni’mah, “Perbandingan Metode RT-PCR dan Tes Rapid Antibodi untuk Deteksi COVID-19,” *J. Kesehat. Manarang*, vol. 6, no. Khusus, p. 47, 2020, doi: 10.33490/jkm.v6ikhusus.317.

[3] PAMKI, “Arti Klinis Nilai CT,” 2020. .

[4] T. Alsuliman, R. Sulaiman, S. Ismail, M. Srour, and A. Alrstom, “COVID-19 paraclinical diagnostic tools: Updates and future trends,” *Curr. Res. Transl. Med.*, vol. 68, no. 3, pp. 83–91, 2020, doi: 10.1016/j.retram.2020.06.001.

[5] A. Susilo *et al.*, “Coronavirus Disease 2019: Tinjauan Literatur Terkini,” *J. Penyakit Dalam Indones.*, vol. 7, no. 1, p. 45, 2020, doi: 10.7454/jpdi.v7i1.415.

[6] C. W. Morfi, "Kajian Terkini CoronaVirus Disease 2019 (COVID-19)," *J. Ilmu Kesehat. Indones.*, vol. 1, no. 1, pp. 1–8, 2020, doi: 10.25077/jikesi.v1i1.13.
[7] E. Nurhayati and A. Pratiwi, "Management kasus pneumonia COVID-19 : A literature review," *J. Ber. Ilmu Keperawatan*, vol. 13, no. 2, pp. 100–109, 2020.
[8] B. Etikasari, T. D. Puspitasari, A. A. Kurniasari, and L. Perdanasari, "Sistem informasi deteksi dini Covid-19," *J. Tek. Elektro dan Komput.*, vol. 9, no. 2, pp. 101–108, 2020.
[9] N. Herawati, "Jenis-Jenis Metode Rapid-Test Untuk Deteksi Virus SARS-CoV-2," vol. 11, no. 1, 2020.
[10] P. Pasculli *et al.*, "Chest computed tomography score , cycle threshold values and secondary infection in predicting COVID-19 mortality," vol. 2, pp. 145–154, 2021.
[11] V. P. Shah *et al.*, "Association Between SARS-CoV-2 Cycle Threshold Values and Clinical Outcomes in Patients With COVID-19 : A Systematic Review and Meta-analysis," pp. 1–12, 2021.
[12] J. J. Manurung and A. Sukohar, "Hubungan Antara CT Value pada Test RT-PCR Terhadap Parameter Klinis Pasien COVID-19 Relationship Between CT Value on RT-PCR Test and Clinical Parameters of COVID-19 Patients," vol. 11, no. April, pp. 119–124, 2021.
[13] B. Yanti and U. Hayatun, "Peran pemeriksaan radiologis pada diagnosis Coronavirus disease 2019," *J. Kedokt. Syiah Kuala*, vol. 20, no. 1, pp. 53–57, 2020, doi: 10.24815/jks.v20i1.18300.
[14] M. Irsal *et al.*, "Analysis Exposure Index As an Optimization Effort on Examination Chest Posterior Anterior," *J. Vocat. Heal. Stud.*, vol. 4, no. 2, p. 50, 2020, doi: 10.20473/jvhs.v4.i2.2020.50-54.
[15] D. Cozzi, M. Albanesi, E. Cavigli, C. Moroni, A. Bindi, and S. Luvarà, "Chest X - ray in new Coronavirus Disease 2019 (COVID - 19) infection : findings and correlation with clinical outcome," *Radiol. Med.*, vol. 125, no. 8, pp. 730–737, 2020, doi: 10.1007/s11547-020-01232-9.
[16] F. Elzein *et al.*, "Journal of Infection and Public Health Reinfection , recurrence , or delayed presentation of COVID-19 ? Case series and review of the literature," *J. Infect. Public Health*, vol. 14, no. 4, pp. 474–477, 2021, doi: 10.1016/j.jiph.2021.01.002.
[17] M. Kesehatan, "RONTGEN TORAKS SEBAGAI PREDIKTOR HASIL TES REVERSE TRANSCRIPTION - POLYMERASE CHAIN REACTION (RT-PCR) UNTUK DIAGNOSIS COVID-19 Rachmi Fauziah Rahayu *, Luths Maharina * □ , Adam Prabata **, Ropitasari ***, Widiastuti *, Yuyun Yueniwati **** Abstrak THE ," vol. 8, pp. 100–105, 2021.
[18] C. M. S. Erlina Burhan, Agus Dwi Susanto, Sally Aman Nasution, Eka Ginanjar, Ceva Wicaksono Pitoyo, Adityo Susilo, Isman Firdaus, Anwar Santoso, Dafsah Arifa Juzar, Syafri Kamsul Arif, Navy G.H Lolong Wulung, Dita Adityaningsih, Ari Fahrial Syam, Menaldi Rasmin, I, *PEDOMAN TATALAKSANA COVID-19 Edisi 3 TIM EDITOR Perhimpunan Dokter Paru Indonesia (PDPI) Perhimpunan Dokter Spesialis Kardiovaskular Indonesia (PERKI) Perhimpunan Dokter Spesialis Penyakit Dalam Indonesia (PAPDI) Perhimpunan Dokter Anestesiologi dan Terap*. 2020.
[19] B. Mishra *et al.*, "High proportion of low cycle threshold value as an early indicator of COVID-19 surge," *J. Med. Virol.*, 2021, doi: 10.1002/jmv.27307.
[20] N. Lam, S. N. Muravez, and R. W. Boyce, *A comparison of the Indian Health Service counseling technique with traditional, lecture-style counseling*, vol. 55, no. 5. 2015.
[21] "Bunga Rampai Artikel Penyakit Virus Korona (COVID-19) Editor : Titik Respati."
[22] A. A. Rabaan *et al.*, "Viral dynamics and real-time rt-pcr ct values correlation with disease severity in covid-19," *Diagnostics*, vol. 11, no. 6, 2021, doi: 10.3390/diagnostics11061091.
[23] A. Abdulrahman, S. I. Mallah, A. Alawadhi, S. Perna, E. M. Janahi, and M. M. Alqahtani, "Association between rt-pcr ct values and covid-19 new daily cases: A multicenter cross-sectional study," *Infez. Med.*, vol. 29, no. 3, pp. 416–426, 2021, doi: 10.53854/liim-2903-13.
[24] J. C. Id *et al.*, "SARS-CoV-2 PCR cycle threshold at hospital admission associated with patient mortality," vol. 68, pp. 1–14, 2020, doi: 10.1371/journal.pone.0244777.
[25] K. P. Bappenas, *Studi Pembelajaran Penanganan COVID-19 Indonesia*. 2021.
[26] K. T. Paru *et al.*, "Multi-Drug Resistance Tuberculosis :," vol. 40, no. 2, 2019.