ORIGINAL ARTICLE

Effectiveness of Internet-Based Group Supportive Psychotherapy on Psychic and Somatic Symptoms, Neutrophil-Lymphocyte Ratio, and Heart Rate Variability in Post COVID-19 Syndrome Patients

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ABSTRACT

Background: COVID-19 can have serious long term health consequences, which is called Post-COVID-19 Syndrome (PCS). Currently, the available evidence and understanding of PCS management is limited. Because one of the symptoms of PCS is associated to psychological symptoms, psychotherapy is believed to have a role in the management of PCS. This study aimed to identify the effectiveness of supportive psychotherapy in PCS patients at Cipto Mangunkusumo National General Hospital. Methods: This study was a single blind randomized clinical trial using a pre-and post-test with control group study design. Participants were randomly divided into two groups: a psychotherapy group with 40 participants and an education group with 37 participants. Each group was given internet-based psychotherapy or education three times a week in a form of group consisting of 6-8 participants. Symptom Checklist-90 questionnaire was used to evaluate somatic and psychological symptoms. Heart rate variability and neutrophil lymphocyte ratio were also investigated. Data analysis was performed using the independent T test. Results: An improvement in the SCL-90 score was found to be 17.51 (SD 30.52) in the psychotherapy group and 19.79 (SD 35.10) in the education group, although there was no significant

difference between the two groups (p = 0.771). There was no significant difference between the two groups in decreasing NLR (p = 0.178) and improving HRV (p = 0.560). **Conclusion:** Both internet-based group supportive psychotherapy and education improved psychological and somatic symptoms in PCS patients, although there was no significant difference between the two groups. There was no significant difference between the two groups in decreasing NLR and improving HRV. Suggestions for further research regarding adding frequency of internet-based group psychotherapy in PCS patients and held in the morning to achieve more optimal results.

Keywords: psychosomatic disorder, post COVID syndrome, internet-based group supportive psychotherapy, neutrophil lymphocyte ratio, heart rate variability.

INTRODUCTION

COVID-19 caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS CoV-2) can have serious long term health consequences, which is called Post COVID-19 Syndrome (PCS) or Long COVID.[1] PCS is defined as disease that occurs in individuals with a confirmed or probable history of COVID-19, usually within 3 months of diagnosis, with symptoms and effects that last for at least 2 months and cannot be explained by other alternative diagnoses. Common symptoms include fatigue, shortness of breath, cognitive dysfunction, as well as other symptoms, which generally have impacts on daily functioning. Symptoms may be new-onset, after initial recovery from an acute COVID-19 episode, or persist from the onset of the illness. Symptoms may also fluctuate, or recur over time.[2] The incidence of PCS is estimated at 10-35%, while those who were hospitalized can reach to 85%.[1]

Patients with PCS experience persistence variety of physical and psychological symptoms.[3] Fatigue is the most commonly reported symptom in 1.5-72% of post COVID cases while psychological problems can affect up to 26%. Fatigue persisting for about 3 months post-infection appears to be associated with moderate to severe depression and a worsening quality of life.[4] Houbon Wilke et al also reported that 37.2% of patients with confirmed COVID-19 developed Post Traumatic Stress Disorder (PTSD) at 3 months follow-up, and remained high (26.8%) at 6 months follow-up.[5] Therefore PCS patients are often associated with psychosomatic disorders.

PCS must be managed appropriately, because in addition to disrupting the quality of life of patients and their families, PCS also burdens health system.[6] Various treatment methods have been developed to treat PCS. Currently, the available evidence and understanding of PCS management is limited. Because one of the symptoms of PCS is associated to psychological symptoms, psychotherapy as a psychological intervention is believed to have a role in the management of PCS.[7]

Internet-based psychotherapy is a new breakthrough that is increasingly being used in this pandemic era, because it is more efficient and saves time and is not constrained by distance. Internet-based group psychotherapy is still not widely employed, so further research is still needed. This study sought to evaluate the impact of supportive psychotherapy treatment delivered in the form of groups (three times per week for 1-2 hours) via internet-based teleconsultation in PCS cases. The impact was evaluated using a brief follow-up period of 1-2 days following the third session.

METHODS

This study was a single-blind randomized clinical study using a before-after intervention with control group to evaluate the effectiveness of supportive psychotherapy in PCS patients at Cipto Mangunkusumo National General Hospital during December 2022 to March 2023. The inclusion criteria were patients aged > 18 years; confirmed positive for SARS CoV-2 through molecular RT PCR examination 3 months before recruitment, with symptoms and effects that last for at least 2 months and cannot be explained by other alternative diagnoses; patients with or without comorbidities; patients can communicate and are willing to be interviewed, filling out questionnaires and psychotherapy. Exclusion criteria were psychotic patients and unable to access the internet. Subjects were divided into

2 groups: intervention group who received psychotherapy and control group who received education. The psychotherapy group consisted of 40 people, while the education group consisted of 37 people.

In this study, psychological and somatic symptoms were examined using the SCL-90 questionnaire. We also examined Neutrophil Lymphocyte Ratio (NLR) using blood tests, and Heart Rate Variability (HRV) using the Standard Deviation Normal to Normal (SDNN) index. Examinations were carried out 1-2 days before and after the intervention. In addition, demographic characteristics were also taken. Supportive psychotherapy and education were carried out in groups consisting of 6 – 8 people for 1-2 hours per session. Psychotherapy and education were carried out in 3 sessions in 1 week using zoom application. Psychotherapy and education were conducted by two different people with the same expertise, although no prior analysis was done. The psychotherapy provided was held by the researcher and also supervised by psychosomatic expert and psychiatrists. Supportive psychotherapy was given using a module whose Intellectual Property

Rights has been registered with the number EC00202170140.

This study has received Ethical Clearance from the Faculty of Medicine – University of Indonesia Research Ethics Committee - RSCM with the number KET-1233/UN2.F1/ETIK/ PPM.00.02/2022. This study was also registered in the clinical trials database registration at www.clinicaltrials.gov under the number: NCT05648123.

RESULTS

There were 96 subjects who were first recruited. After screening, 19 subjects were excluded because they refused to participate, could not communicate properly and could not access zoom application. The 77 subjects then were randomly divided into two groups: 40 subjects received psychotherapy and 37 subjects received education. Subjects who successfully completed the study to the end were 37 subjects in the psychotherapy group and 34 subjects in the education group. Three subjects in each group did not complete the study. This study used per protocol analysis.
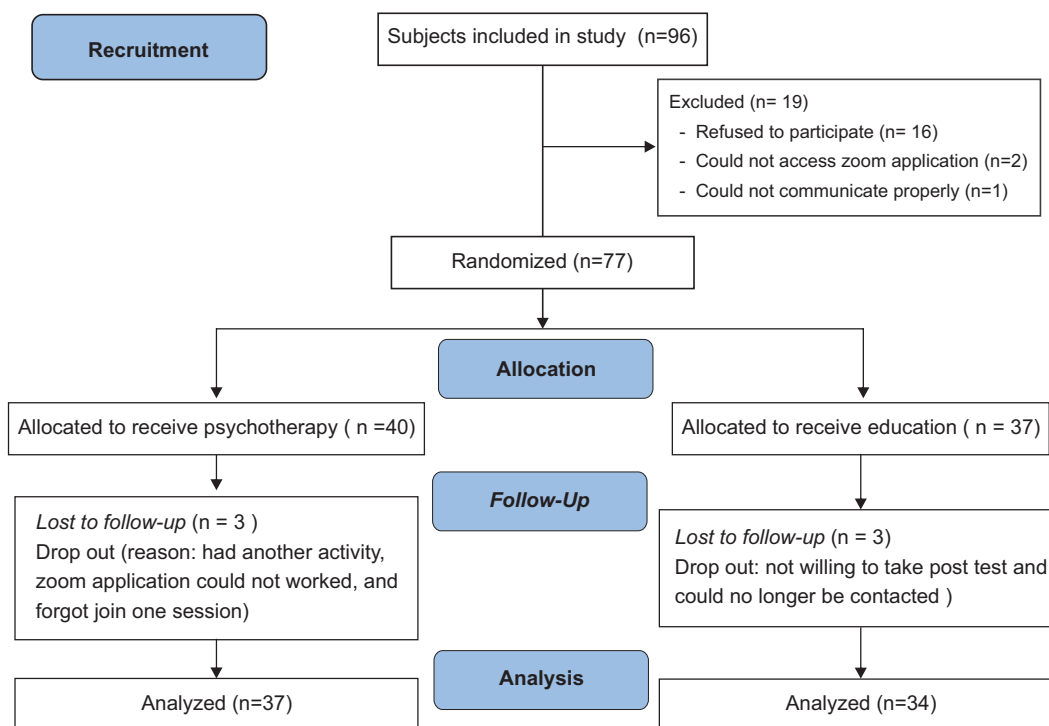

Figure 1. Flow of Subjects Recruitment.

The psychotherapy group has a median age of 43 years, whereas the education group has a median age of 33 years (**Table 1**). The study's participants are predominantly female, accounting for 76% of the sample overall. The majority of subjects work in health care (16.9%) or as housewives. The fourth vaccination showed the highest history rate at 46.8%. Furthermore, 77.9% of patients did not require hospitalization.

The psychotherapy and education groups had a median NLR of 2.06 and 1.825, respectively. The psychotherapy group had a median SCL-90 score of 76, while the education group had a median score of 99. The median HRV for the psychotherapy group was 29.88, whereas for the education group it was 40.66. Both groups had a high prevalence of 62.2% (psychotherapy), and

61.8% (education) of subjects with normal HRV. This research identified that the distribution of subjects was nearly equal between those with comorbidities and those without. Subjects with comorbidities accounted for 45.5%, and subjects without accounted for 54.5%. Hypertension was the most common comorbid condition, representing 26%. Mild severity of COVID-19 was the most frequently observed, accounting for 75.3%.

In the independent T-test carried out to assess the pre-test and post-test differences between both groups, an improvement in the SCL-90 score of 17.51 (SD 30.52) was observed in the psychotherapy group and 19.79 (SD 35.11) in the education group, with a p-value of 0.771 (**Table 2**). While the effect on NLR showed

Table 1. Basic Characteristic of Participants

Characteristic	Psychotherapy (n=40)	Education (n=37)
Age (year), median (IQR)	**43 (29.25 – 56.0)**	**33 (28 – 43.5)**
Gender, n (%)		
- Male	11 (27.5)	7 (18.9)
- Female	29 (72.5)	30 (81.1)
Occupation, n (%)		
- Housewives	9 (22.5)	4 (10.8)
- Healthcare workers	9 (22.5)	4 (10.8)
- Retired civil servants	6 (15)	2 (5.4)
- Pharmacists	5 (12.5)	7 (18.9)
- Private employees	4 (10)	8 (21.6)
- Honorary employees	3 (7.5)	2 (5.4)
- Entrepreneurs	0 (0)	7 (18.9)
- Government employees	1 (2.5)	3 (8.1)
- Not yet working	2 (5)	2 (5)
- Others	1 (2.5)	2 (5.4)
Vaccination History, n (%)		
- Not vaccinated	5 (12.5)	3 (8.1)
- First dose	0 (0.0)	1 (2.7)
- Second dose	3 (8.1)	6 (16.2)
- Third dose	12 (30.0)	11 (29.7)
- Fourth dose	20 (50.0)	16 (43.2)
Time symptoms persisted after COVID-19 infection, n (%)		
- > 3 months – 6 months	16 (40.0)	13 (35.1)
- > 6 months - < 1 year	9 (22.5)	8 (21.6)
- ≥ 1 year	15 (37.5)	16 (43.2)
Hospitalized, n (%)		
- Yes	9 (22.5)	8 (27.5)
- No	31 (77.5)	29 (78.4)
Neutrophil Lymphocyte Ratio (median, IQR)	2.06 (1.485 – 3.125)	1.825 (1.402 – 2.445)
SCL-90 score (median, IQR)	76 (48.25 – 105)	99 (69 – 133)
SCL-90 score, n (%)		
- ≥ 61	25 (62.5)	29 (78.4)
- < 61	15 (37.5)	8 (21.5)
Heart Rate Variability (median, IQR)	29,88 (22.27 – 60.49)	40.66 (21.44 – 49.82)
Heart Rate Variability, n (%)		
- Normal	23 (62.2)	21 (61.8)
- Low	14 (37.8)	13 (38.2)

Comorbid, n (%)		
- Yes	18 (45.0)	17 (45.9)
- No	22 (55.0)	20 (54.1)
Hipertension, n (%)		
- Yes	10 (25)	10 (27)
- No	30 (75)	27 (73)
Severity of COVID-19, n (%)		
- No symptom	3 (5.0)	1 (2.7)
- Mild	29 (72.5)	29 (78.4)
- Moderate	9 (22.5)	7 (18.9)
PCS symptoms, n (%)		
- Psychic symptoms		
• Anxiety	10 (25)	9 (24.3)
• Depression	2 (5)	1 (2.7)
- Somatic symptoms		
• Neuromusculoskeletal symptoms		
1. Fatigue	30 (75)	27 (73)
2. Headache/ vertigo	11 (27.5)	16 (43.2)
3. Memory loss/ impairment	15 (37.5)	11 (29.7)
4. Joint/ mucle/ nerve pain	10 (25)	15 (40.5)
5. Insomnia	8 (20)	11 (29.7)
• Respiratory symptoms		
1. Cough	9 (22.5)	13 (35.1)
2. Shortness of breath	6 (15)	9 (24.3)
• Cardiology symptoms		
1. Palpitation	6 (15)	6 (16.2)
2. Chest pain	1 (2.5)	6 (16.2)
• Gastrointestinal symptoms	8 (20)	14 (37.8)
• Other symptoms	20 (50)	17 (45.9)
Medication history, n (%)		
• No history of treatment	22 (55)	16 (43.2)
• Vitamin and supplement	11 (27.5)	8 (21.6)
• Antihypertensive	10 (25)	9 (24.3)
• Glucose lowering agent	3 (7.5)	2 (5.4)
• Pain killer	4 (10)	3 (8.1)
• GIT drugs (PPI, etc)	3 (7.5)	8 (21.6)
• Antihistamines	3 (7.5)	2 (5.4)
• Mucolytic	2 (5)	2 (5.4)

an improvement in the psychotherapy group to be 0.14 (SD 1.08), NLR in the education group increased by 0.22 (SD 1.23), with a p-value of 0.178. There was no improvement in HRV observed in either group. However, the psychotherapy group showed a reduction in HRV by 1.02 (SD 14.17), and the education group exhibited a decrease of 3.45 (SD 20.50), with p = 0.560.

Table 2. Effect of Internet-Based Group Supportive Psychotherapy and Education on SCL-90, NLR, HRV and VAS.

Variables	Group		CI (95%)	p
	Psychotherapy	Education		
SCL-90				
Pre test	82.98 (SD 51.95)	103.05 (SD 56.59)	-44.721 – 4.563	0.109
Post test	63.30 (SD 40.48)	85.03 (SD 56.17)	-4.776 – 1.312	0.064
Delta	-17.51 (SD 30.52)	-19.79 (SD 35.10)	-13.262 – 17.823	0.771
NLR				
Pre test	2.53 (SD 1.44)	1.99 (SD 0.78)	-0.024 – 1.087	0.061
Post test	2.46 (SD 1.15)	2.22 (SD 1.12)	-0.281 – 0.755	0.365
Delta	-0.14 (SD 1.08)	0.22 (SD 1.23)	-0.922 – 0.174	0.178
HRV				
Pre test	35.36 (SD 15.89)	38.62 (SD 19.37)	-11.625 – 5.099	0.439
Post test	33.34 (SD 15.14)	34.54 (SD 19.07)	-8.982 – 6.596	0.761
Delta	-1.02 (SD 14.17)	-3.45 (SD 20.50)	-5.856 – 10.723	0.560

Independent t-test

Independent T-test

Both supportive psychotherapy and education significantly improved SCL-90 (p < 0.0001 for psychotherapy and p = 0.002 for education). However, neither psychotherapy nor education reduced NLR or significantly increased HRV according to **Table 3**.

Dependent T-test

We investigated the impact of supportive psychotherapy and education on psychosomatic conditions using a visual analogue scale at each session. Both interventions had a significant positive influence on psychosomatic conditions throughout all the sessions (**Table 4**).

Table 3. Effect of Internet-Based Group Supportive Psychotherapy and Education on SCL-90, NLR and HRV.

Intervention	Variable	Pre Intervention	Post Intervention	CI (95%)	p
Psychotherapy					
	SCL-90, Mean (SD)	80.81 (SD 51.41)	63.30 (SD 40.48)	7.34 – 27.68	**<0.0001**
	NLR, Mean (SD)	2.53 (SD 1.44)	2.38 (SD 1.10)	-0.22 – 0.51	0.423
	HRV, Mean (SD)	35.36 (SD 15.89)	34.33 (SD 15.33)	-3.70 – 5.75	0.663
Education					
	SCL-90, Mean (SD)	104.82 (SD 52.27)	85.03 (SD 57.17)	7.54 – 32.04	**0.002**
	NLR, Mean (SD)	1.99 (SD 0.78)	2.22 (SD 1.16)	-0.66 – 0.20	0.285
	HRV, Mean (SD)	38.62 (SD 19.37)	35.16 (SD 19.21)	-3.69 – 10.61	0.332

Dependent T-test

Table 4. Effect on Supportive Psychotherapy and Education on Psychosomatic Conditions Based on A Visual Analog Scale in Each Session.

Intervention	Variable	Pre-Intervention	Post Intervention	CI (95%)	p
Psychotherapy					
- Session 1	Psychic, mean (SD)	7.24 (SD 1.68)	7.87 (SD 1.36)	-1.009 – (-0.254)	**0.002**
- Session 2	Psychic, mean (SD)	7.50 (SD 1.52)	8.11 (SD 1.27)	-0.943 – (-0.267)	0.001
- Session 3	Psychic, mean (SD)	7.76 (SD 1.52)	8.59 (SD 0.93)	-1.257 – (-0.418)	**< 0.0001**
- Session 1	Somatic, mean (SD)	7.24 (SD 1.65)	7.87 (SD 1.39)	-0.951 – (-0.313)	**< 0.0001**
- Session 2	Somatic, mean (SD)	7.34 (SD 1.63)	7.89 (SD 1.39)	-0.900 – (-0.205)	**0.003**
- Session 3	Somatic, mean (SD)	7.62 (SD 1.53)	8.41 (SD 1.09)	-1.201 – (-0.367)	**0.001**
Education					
- Session 1	Psychic, mean (SD)	7.11 (SD 1.59)	7.63 (SD 1.70)	-0.769 – (-0.259)	**< 0.0001**
- Session 2	Psychic, mean (SD)	7.43 (SD 1.33)	8.09 (SD 1,31)	-0.892 – (-0.422)	**< 0.0001**
- Session 3	Psychic, mean (SD)	7.63 (SD 1.37)	8.29 (SD 1.87)	-1.246 – (-0.068)	**0.03**
- Session 1	Somatic, mean (SD)	7.11 (SD 1.39)	7.60 (SD 1.29)	-0.754 – (-0.217)	**0.001**
- Session 2	Somatic, mean (SD)	7.60 (SD 1.26)	8.09 (SD 1.22)	-0.741 – (-0.231)	**< 0.0001**
- Session 3	Somatic, mean (SD)	7.49 (SD 1.31)	8.17 (SD 1.42)	-1.074 – (-0.297)	0.001

Paired T-test

DISCUSSION

In this study, the psychotherapy group had a median age of 43 years, while the education group had a median age of 33 years. Though there was no statistical significance in age, clinically, the age difference of ten years between the groups could have impacted the results. In this study, it was observed that the majority of participants were female, comprising 76.6%. A prospective cohort study conducted by Bai et al demonstrated that female gender is associated with PCS.[8] This may also be brought on by psychological problems that are included as one of the symptoms of PCS, where risk factors for persistent psychological symptoms like anxiety and depression include female sex.[1] From the research, it was found that the most occupation of subjects were housewives and health care workers. There are no studies that assess the tendency of certain occupations to suffer from PCS. But PCS is associated the the possibility of not being able to work or being able to work full time. [9] Al Qaraibi et al are conducting a systematic review of the prevalence of PCS in health care workers, but to date the findings have not yet been published. [10] Majority of participants in this study (77.92%) had milder forms of COVID-19, and 75.3% were not hospitalized. This was consistent with a study by Mohamed Husein et al., that found PCS rose in patients who weren't hospitalized. Individuals with PCS who had previously been hospitalized experienced greater respiratory symptoms than non-hospitalized individuals, who experienced more neuropsychiatric symptoms.[11]

In this study, it was found that 46.8% of those who had received the fourth vaccination had a higher prevalence of PCS. The correlation between vaccination and PCS remains uncertain. This was also upheld by a systematic review conducted by Notarte et al, which indicated that there is a low level of evidence (level III, case-control and cohort studies) to suggest that vaccination prior to SARS-CoV-2 infection can reduce the risk of PCS. The effect of vaccination on PCS is subject to debate, as certain data suggest an amelioration of symptoms while others do not..[12]

In this study, fatigue was the most prevalent symptom, accounting for 74.03%, followed by headache/vertigo at 35.06% and memory loss/impairment at 33.77%. Besides these primary symptoms, 15 diverse secondary symptoms were also noted. This finding is consistent with the WHO's 2021 Delphi consensus, which confirms the variation of PCS symptoms.[2] Aiyegbusi et al also found fatigue as the most common symptom.[3] The length of time suffering from PCS also varies, most are > 3 months – 6 months and ≥ 1 year. According to a retrospective cohort study carried out by Mizrahi et al in Israel, individuals with a mild history of COVID-19 will experience PCS symptoms for several months, which will gradually improve over the course of a year.[13] However, the NICE guidelines state that PCS usually presents with a variety of symptoms, often overlapping, which can fluctuate and change over time.[14]

This study found that the proportion of patients with and without comorbidities was nearly equal. Pavli et al. reported that over a third of PCS patients had additional conditions, with hypertension being the most prevalent, followed by diabetes mellitus, cardiovascular disease, lung disease and obesity.[1]

The psychotherapy group had a median SCL-90 score of 76, compared to 99 in the education group, suggesting a psychopathological condition. In the psychotherapy group, 62.5% of subjects had an SCL-90 score ≥ 61, whereas the education group had 78.4%. The 23-point difference in median scores between the two groups might have had a clinical impact on the intervention results, but there was no statistically significant difference. A study carried out by Clemente et al on long COVID patients assessed their psychological status using the SCL-90 questionnaire. The study discovered that during the initial 3 months following transmission, patients who recuperated from SARS-CoV-2 infection had a considerable probability of developing somatization, depression and anxiety.[15]

This study revealed median neutrophil-lymphocyte ratios of 2.06 in the psychotherapy group and 1.825 in the education group. Maamar et al.'s research indicated a correlation between elevated neutrophil-lymphocyte ratios in patients

with PCS.[16]

In this study, the psychotherapy group displayed a median heart rate variability of 29.88 ms, compared to 40.66 ms in the education group. In both groups, heart rate variability reached its highest at normal levels. The 10.78 ms HRV difference between the groups may have had a clinical impact on the results, although it did not prove statistically significant. A comparable finding was identified by Asarcikli et al, who noted parasympathetic activity and HRV increasing in PCS patients.[17]

From the results obtained, the average SCL-90 score decreased significantly in the psychotherapy group compared to the pretest value. The same effect was also observed in the control group. These findings suggest a positive impact of supportive and educational psychotherapy on the SCL-90 score. However, comparisons between the two groups showed no significant differences with a p-value of 0.771. Research on psychotherapy in PCS is still limited. There are no studies assessing the effects of psychotherapy in PCS patients on SCL-90 scores to date. Research conducted by Kuut et al on 114 patients using cognitive behavioral therapy (CBT) for 17 weeks is still ongoing and has not been published.[18] In the management of PCS, the NICE guidelines and several studies recommend psychotherapy in combination with rehabilitation therapy and other approaches.[14,19,11]

The therapeutic alliance comprises three components, of which two involve reaching an agreement on achievable goals and tasks in virtual groups. However, the quality of the relationship, which is essential in psychotherapy, remains uncertain. Due to the fact that interpersonal ties are crucial in psychotherapy, it is anticipated that the psychotherapy group's gains in psychological and physical symptoms will be less than those in the education group. The absence of direct interaction in virtual groups can be considered as the main obstacle in the transition from gathering in circles to screen forms. The absence of eye contact is also an obstacle for the therapist, where not all samples are willing to open the video. Presence is hard to achieve through on-screen relationships, due to numerous distractions. [20,21]

In addition, the administration of psychotherapy carried out at night may have an effect on the results. Studies seem to show that early morning is the most effective time to take a therapeutic measure.[22]

This study revealed that supportive psychotherapy led to a decrease in NLR, whereas education had the opposite effect. Both the psychotherapy and education groups showed NLR within normal range in the pre- and post-test. No previous studies have explored the impact of supportive psychotherapy on NLR in PCS patients.

There was a decrease in HRV by 1.02 in the psychotherapy group and 3.45 in the education group, respectively. The statistical analysis showed no significant difference between pre-test and post-test values of both groups, with p = 0.56. This HRV measurement can produce different results as it is influenced by external factors, including age and gender, sampling time, nicotine use or caffeine consumption, physical activity, food and drink intake, tension during measurements, and the presence of coexisting illnesses.[23,24] HRV measurements that were taken 1-2 days after the participant completed the third session of psychotherapy may have affected the results. Additionally, the pre-intervention HRV values were clinically quite different between groups.

Both psychotherapy and education improve psychosomatic conditions in all sessions. Immediate improvements after the completion of each session were observed in both groups. It is worth considering that education was administered three times in this study, which is typical for psychotherapy, rather than just once. This may have contributed to the significant improvements observed in the education group.

All psychotherapy sessions in this study were conducted by the researchers themselves as therapists, which has the potential to introduce measurement bias. It would be better if future research is conducted with therapists who are not part of the research team. Furthermore, potential bias may also be present due to the fact that psychotherapy and education in both groups were conducted by two different people. This study did not identify appropriate participants

for group psychotherapy prior to the session. Moreover, a patient whose personality traits conflict with one group may be appropriate for another.[25] Selecting patients for placement in a particular group was challenging in this study due to its design as a randomized clinical trial. Therefore, we suggest that for future research, screening should be conducted beforehand to identify patients who may be suitable for inclusion in group psychotherapy. The following suggestion is to fulfill specific prerequisites before participating in an Internet-based group psychotherapy session. The primary requirement is that the participant can access videos during the psychotherapy session. This is intended to enhance the participant's concentration and focus, leading to improved therapeutic alliances with the therapist and interpersonal relationships between participants involved in psychotherapy. In addition, it is important that participants in psychotherapy are in a calm and conducive environment to fully engage in sessions. The management of PCS is a relatively new and continuously developing field. Research using different psychotherapy methods, including individual and group-based, in-person, and online, remains limited. Thus, further research is necessary to expand our understanding in this area.

The strength of this study is that there has not been any similar research related to psychotherapy for PCS in Indonesia Furthermore, few studies have examined the benefits of group-based internet psychotherapy, making this study valuable. The employment of RCT adds strength to the research design. However, this study's limitations are the lack of standardization for the duration and frequency of internet-based group psychotherapy. Psychotherapy conducted during nighttime with patients returning from work, feeling fatigued and lacking concentration, presents limitations that must be acknowledged. Furthermore, not all subjects are willing to open videos during psychotherapy sessions.

CONCLUSION

The study findings revealed that internet-based group supportive psychotherapy led to a significant improvement in both psychological and somatic symptoms, although no significant difference was observed compared to education. However, NLR and HRV showed no significant improvement. It was found that internet-based group supportive psychotherapy is less effective in patients with PCS. If internet-based group supportive psychotherapy is offered, it should be tailored to the individual.

Suggestion

Recommendations for further research regarding adding frequency of internet-based group psychotherapy in PCS patients and held in the morning to achieve more optimal results.

AUTHORS CONTRIBUTIONS

This study was developed by HS, designed, directed, and coordinated by HS, DIS, CLM, and SS as the principal investigator, provided conceptual and technical guidance for all aspects of the project. RP, EG, IR and EY co-conceived the study, sample selection, and outcome parameters assessed. DIS conducted psychotherapy, supervised by HS, RII, and PRL. Data was analyzed by HS, DIS and SS. All authors participated in contributing to text and the content of the manuscript, including revisions and edits. All authors approve of the content of the manuscript.

CONSENT TO PARTICIPATE

Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

COMPETING INTERESTS

The authors declare no competing interest.

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