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Effects of Psychosocial Interventions on Physical Function and Depression in Stroke Patients: Systematic Review and Meta-analysis

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뇌졸중 환자를 위한 심리사회중재가 신체기능과 우울에 미치는 효과분석: 체계적 고찰 및 메타분석

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Abstract

The purpose of this study was to systematically review domestic and foreign randomized controlled trials (RCT) of psychosocial interventions in stroke patients, and analyze the overall and individual intervention type effect sizes through meta-analysis. This study followed the Cochrane Systematic Reviews Handbook of the Cochrane Collaboration and Preferred Reporting Items for Systematic Reviews and Meta-Analyses recommended by the PRISMA group. Research papers published between 1990 and 2020 were selected using PICO-SD to search foreign and domestic databases; a total of 27 and 23 papers were selected for systematic reviews and meta-analysis, respectively. Stroke patients who received psychosocial interventions showed significant improvement in physical function and reduced depression, but the effect sizes were small. Analyzing the psychosocial intervention effects by type showed that social support significantly improved physical function and behavioral therapy significantly reduced depression, but their effect sizes were also small. This study confirmed that psychosocial interventions with stroke patients have a significant effect on physical function and depression, providing basic data for future investigations on the most effective intervention elements and methods for improving physical function and reducing depression in stroke patients.

Key words : Stroke, Meta-analysis, Recovery of function, Depression

Ⅰ. Introduction

Stroke is a medical condition resulting from damaged brain tissue following an interruption of cerebral blood flow from cerebrovascular rupture or obstruction (Sacco et al., 2013). Stroke prevalence is rising, increasing from 6.9% in 2014 to 7.1% in 2017 (Korea Institute for Health and Social Affairs, 2017), and with the global population aging, the prevalence is expected to increase three-fold by 2030 (Kim et al., 2019). Only 9% of patients completely recover from stroke and 70% experience disability in various areas (Kumar et al., 2010), depending on the damaged brain areas; therefore

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interventions that facilitate fuller recovery are needed.

Stroke patients may experience physiological symptoms, such as hemiplegia, reduced cognitive and sensory functions, activity intolerance, and language disorders (Tseng and Kluding, 2009), as well as psychological maladjustments, such as depression (Riedel et al., 2012). Stroke-related physical disabilities cause temporary or permanent functional loss and decrease patients' ability to perform basic activities of daily living, resulting in depression, which has a negative effect on recovery (Kim et al., 2013). Accordingly, appropriate interventions should be provided early in the hospitalization stage to prevent stroke complications and minimize disabilities. Interventions should prevent secondary complications such as depression by helping patients re-engage in daily activities to help stabilize their emotions (Kim et al., 2017).

Stroke patients' reduced physical function may also lead to social isolation, not only through decreased self-care ability, which occurs in about 40% of patients (Wang et al., 2015), but also through reduced effort to return to society (Susan et al., 2010). The frequency of post-stroke depression varies from 11% to 80%, and it most frequently occurs three to six months after stroke onset (Robinson and Spalletta, 2010; Son, 2015). Depression requires effective management because it not only reduces patients' rehabilitation efforts, it also reduces physical function (Shi et al., 2016; Salinas et al., 2016) and increases length of stay, medical expenses (Bugge et al., 1999), and mortality rates (Williams, 2005).

To alleviate the physical function and depression problems experienced by stroke patients, various psychosocial interventions have been developed and applied, including behavioral therapy, counseling, health education, and social support (Thompson and Ski, 2013). These psychosocial interventions provide effective emotional and instrumental support for stroke patients' recovery, and help increase self-efficacy related to recovery of function. Psychosocial interventions, such as effective health education or social support, facilitate physical function and mental health recovery and improved self-management (Glass et al., 2000).

The results from previous studies that applied psychosocial interventions to stroke patients have been inconsistent. Some studies reported significant effects for psychosocial interventions improving physical function (Cho et al., 2016; Liu et al, 2018; Sit et al., 2016; van de Ven et al., 2017; Wang, et al, 2020), while others reported no significant effects on physical function (Askim et al., 2018; Ertel et al, 2007; Smith et al., 2004). Research findings regarding depression were also conflicting: some reported that psychosocial interventions effectively reduced patients' depression (Fang et al., 2017; Mitchell et al., 2009; Wakins et al., 2007), while others reported increased depression (Hoffmann et al., 2015). It is also necessary to investigate psychosocial intervention effects on physical function and depression in terms of depression's negative effect on physical function, which reduces stroke patients' self-care activities (Chau et al., 2009).

The current emphasis on the importance of evidence-based practice asserts that we may need to understand each intervention's effect first to practice evidence-based nursing that improves stroke patients' physical function and reduces depression. Therefore, this study conducted a systematic literature review and meta-analysis to derive comprehensive and objective conclusions by collecting, analyzing, and integrating published research on the effects of

psychosocial interventions on stroke patients' physical function and depression. The results help to identify the most effective psychosocial intervention strategies for improving stroke patients' physical function and reducing depression.

Ⅱ. Methods

1. Selection criteria

This study followed the Cochrane Systematic Reviews Handbook of the Cochrane Collaboration (Higgins and Green, 2011) and the Preferred Reporting Items for Systematic Reviews and Meta-analyses recommended by the PRISMA group (Moher, Liberati, Tetzlaff, and Altman, 2010). To select literature, key search terms (PICO-SD) that reflected review items for psychosocial interventions for stroke patients were used to search domestic and foreign electronic databases.

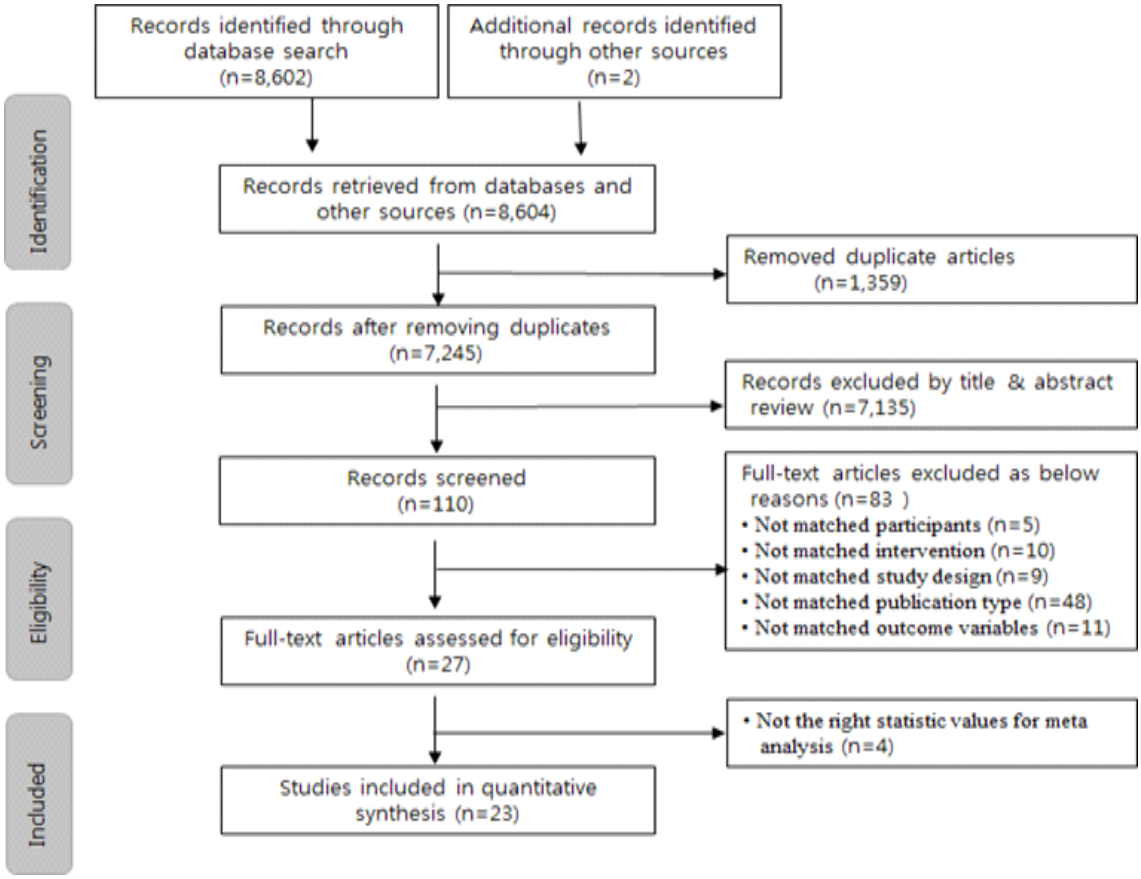
The selection criteria for inclusion of studies was as follows: study participants were stroke patients aged 18 years or older; the study used psychosocial interventions on stroke patients, including behavioral therapy, counseling therapy, health education, and social support; the study control group comprised stroke patients who did not receive psychosocial interventions; study outcomes were quantitative values of physical function and depression; the study used a randomized controlled trial design; and the paper was published in English or Korean. The exclusion criteria were as follows: studies where patients had other serious comorbidities in addition to stroke; studies that measured the effects of other interventions (e.g., not psychosocial interventions); studies that were not randomized controlled trials; and studies that were research proposals or conference research presentations.

2. Study selection

The investigators selected keywords for each database and established a search strategy using the Medical Subject Headings (MeSH) and terminology index for life science (EMTREE) to search for studies conducted between January 1990 and April 2020. Foreign literature was searched on PubMed, Excerpta Medica dataBASE (EMBASE), Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Cochrane Register Controlled Trials (CENTRAL); and domestic literature was searched on Korean Medical Database (KMbase), Korean Association of Medical Journal Editors (KoreaMed), Research Information Sharing Service (RISS), and Koreanstudies Information Service System (KISS). In addition, after searching these databases online, reference lists were searched manually. MeSH terms and keywords in titles and abstracts were searched using Boolean operators (“and” and “or”) and wildcards. The search words were as follows: “Stroke"[Mesh] OR “Cerebrovascular Accident" OR “Brain Vascular Accident” AND “psychosocial” OR “psychoeducat*” OR “health education” OR “educat*” OR “cognitive”, OR “behavioral” OR “cognitive-behavioral” OR “support” OR “social support” OR “counsel*” OR “psychological” OR “intervention” OR “therapy” OR “program” AND “depression” OR “depressive symptom” OR “emotional depression” OR “depressive disorder” OR “activities of daily living” OR “Barthel Index” OR “Functional Independence Measure” OR “functional outcome” OR “functional well-being.”

3. Data extraction

Throughout the data collection and selection process, two investigators independently reviewed all studies included in the analysis. If there was a



[Fig. 1] Flow diagram of study selection.

disagreement, the study was reviewed together according to data selection or exclusion criteria until an agreement was reached. After removing duplicate literature, titles and abstracts were reviewed to ensure consistency with the selection criteria. If the title or abstract did not provide enough information to determine whether the article met the selection criteria, the decision was made by referring to the full text article. From the final selection of articles, the following information was extracted: author, publication year, country of publication, number of participants, average age, intervention type, intervention target, type of intervention provided, intervention period, number of sessions, outcome instruments, and outcome variables.

4. Quality assessment

A quality evaluation of the selected articles was conducted independently by the two investigators using Cochrane's Risk of Bias (ROB) tool. If there was disagreement, the study was reviewed together until an agreement was reached. The risk of bias was categorized as low, high, or unclear, depending on the content of each item.

5. Statistical analysis

The number of participants, average age, intervention type, number of sessions, outcome instruments, and outcome variables were coded; then, pre- and post-averages, standard deviations, p values, and sample sizes from each study were summarized. If multiple measurements were made, the first measurement made immediately after the psychosocial intervention ended was used. Effect size and homogeneity were analyzed using Cochrane Library's RevMan 5.2 and R Studio 3.2.3. First, standardized mean differences were calculated to standardize the results of various scales to one unit, allowing us to calculate the effect sizes. Statistical significance of the effect size was determined by the overall effect test and 95% confidence intervals, using a significance level of .05. A Q-value was calculated using the chi-square test to check for heterogeneity of the combined effect sizes. A fixed effects model was used if homogeneity was observed and a random effects model was used if heterogeneity was observed. The degree of heterogeneity of the random effects model was determined using I2, which shows the rate of dispersion between studies; the degree of heterogeneity was determined to be small, medium, or large if I2 was 25%, 50%, or 75%, respectively. A forest plot was used to determine the direction of the effect size for each study, and confidence interval overlap across studies was determined.

Funnel plots, which visualize the relationship between sample size and effect size, were used to test publication bias. In addition, test result reliability was determined using Egger's regression test.

Ⅲ. Results

1. Data selection

A total of 27 studies were selected according to the research selection criteria for systematic review. The selected studies stemmed from a total of 8,604 studies identified through the search strategies. The number of foreign studies included was 3,482 from PubMed, 1,387 from EMbase, 2,229

from the Cochrane Library, and 1,479 from CINAHL. The number of domestic studies included was 4 from KoreaMed, 12 from RISS, 4 from KMbas, and 5 from KISS. Two additional studies were found through manual searches of reference lists from the studies found in the databases.

In the final selection process, the first step included removing 1,359 overlapping articles using the reference management program EndNote X9. Second, the remaining 7,245 articles were reviewed by the two investigators, focusing on the title and abstract. This process eliminated 1,138 studies that did not conform to participant selection criteria, 3,105 studies that did not use psychosocial interventions, 847 studies that did not conform to the research design selection criteria, 1,794 studies that matched the exclusion criteria for publication format, 162 studies whose outcome variables did not conform to the selection criteria, and 89 studies that were published in languages other than English or Korean, which left 110 studies in the preliminary selection. In the third step, the full text from each of these studies was reviewed according to the original inclusion criteria and search terms. A total of 27 of the 110 studies were eventually selected for systematic review. Five were excluded because they did not conform to the participant selection criteria, 10 did not use psychosocial interventions, 9 did not conform to the research design selection criteria, 48 matched the exclusion criteria for publication format, and 11 used outcome variables that did not conform to the

selection criteria. Twenty-three of these studies were selected for the meta-analysis ([Fig. 1]). The four excluded studies did not present necessary statistics, such as means and standard deviations.

2. Methodological quality assessment of psychosocial intervention research

Using the Cochrane Library's Risk of Bias (RoB) tool, 7-item methodological quality assessments were performed on the 27 studies. Twenty studies (74.1%) had a low bias risk because they included sufficient explanations for random sequence generation; whereas seven (25.9%) stated that they used random assignment but did not accurately describe the method. Sixteen (59.3%) studies concealed allocation, and 11 (40.7%) did not adequately describe allocation concealment so it could not be determined. Fourteen (51.9%) studies clearly stated that they blinded participants and personnel, and 13 (48.1%) clearly described blinding the outcome assessment. Twenty-four studies (88.8%) were assessed to have a low risk of bias because there were no dropouts or the dropout rate effect on the result was minimal. Twenty-six studies (96.2%) were assessed to have a low risk of bias because they presented results according to an a priori protocol, and all other potential biases were assessed to be low.

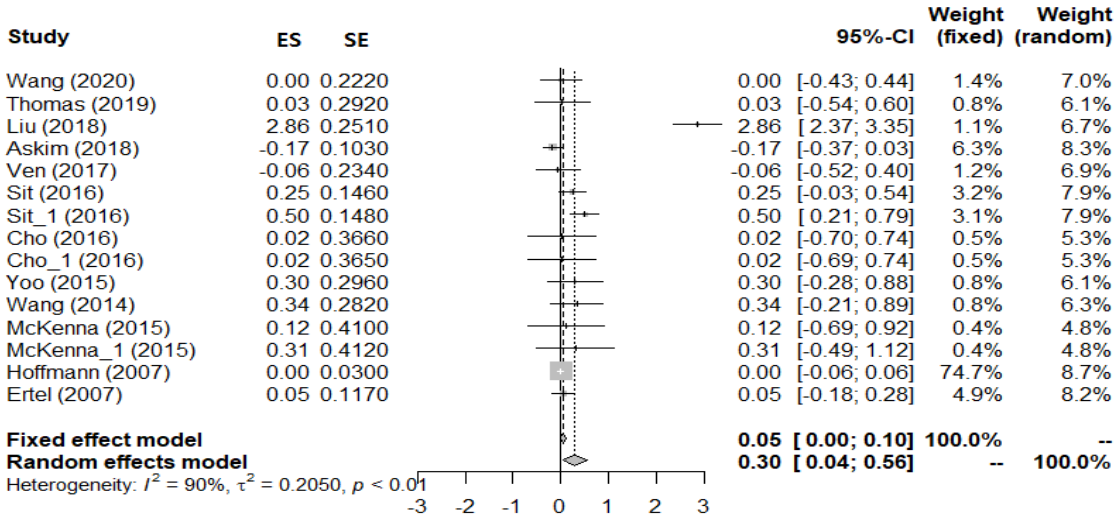
3. Characteristics of research

The characteristics of the 27 psychosocial intervention studies were summarized by author, publication year, publication type, outcome variables, and program characteristics. The average participant age ranged from 50s to 70s, except for six studies (22.2%) that did not report participants' mean age. The most prevalent type of psychosocial intervention was behavioral therapy (13 studies, 48.1%), followed by education (8 studies, 29.6%), social support (5 studies, 18.5%), and counseling (1 study, 3.7%). Twenty-one studies (77.7%) provided individual psychosocial interventions, and five studies (18.5%) provided group intervention. The intervention provision methods included 17 (62.9%) offline and two (7.4%) online. The most frequent intervention period was 4-8 weeks (10 studies, 37.0%) followed by less than four weeks (2 studies, 7.4%). Ten studies (37.0%) had eight or fewer sessions, 12 (44.4%) had 9-18 sessions, and four (14.8%) had 20 or more sessions. Sixteen studies (59.3%) measured depression outcomes and 18 (66.7%) measured physical function outcomes.

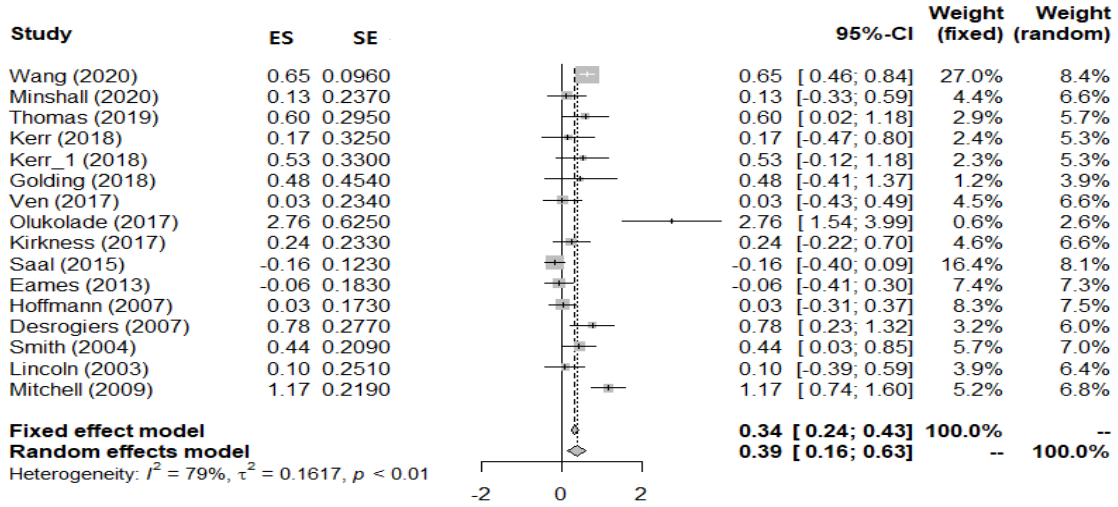
4. Psychosocial intervention effect sizes

4.1. Psychosocial intervention outcome variable effect size

The effect sizes of psychosocial interventions on physical function and depression in stroke patients were analyzed for the 23 meta-analyzable studies (identified by the name of the first author). Physical function effect sizes were calculated using a random effects model because the studies on physical function were determined to be homogenous ($Q=146.18$, $p<.001$, $I^2=90.4\%$). The overall effect size on physical function was small (0.30, 95% CI: 0.04-0.56) but statistically significant ($Z=2.25$, $p=.024$). Since Sit et al. (2016) and McKenna, Jones, Glenfield, and Lennon (2015) used two physical function scales in their respective studies, and Cho, Kim, and Jung (2016) applied two types of behavioral therapies, two measurement values for each study were included ([Fig. 2]).



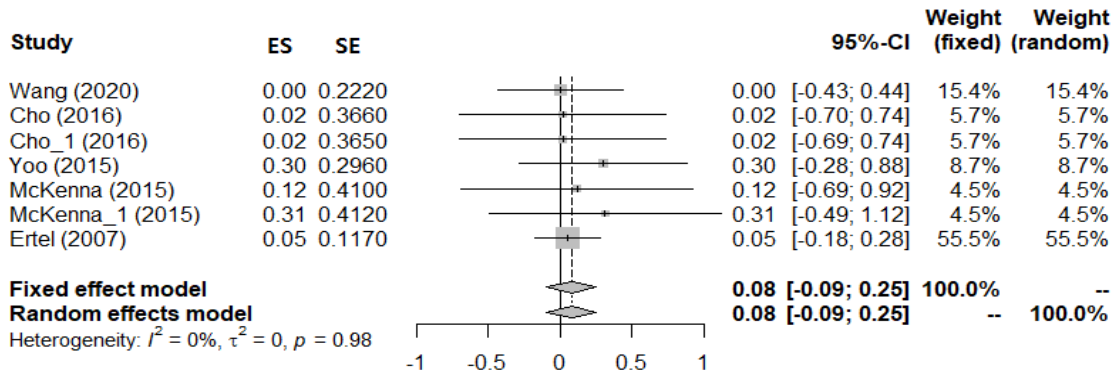
Q=146.18, df=14 (p<.001); Test for overall effect: Z=2.25 (p=.024)
(2A) The effect of psychosocial intervention on physical function



Q=71.72, df=15 (p<.001); Test for overall effect: Z=3.27 (p=.001)
(2B) The effect of psychosocial intervention on depression

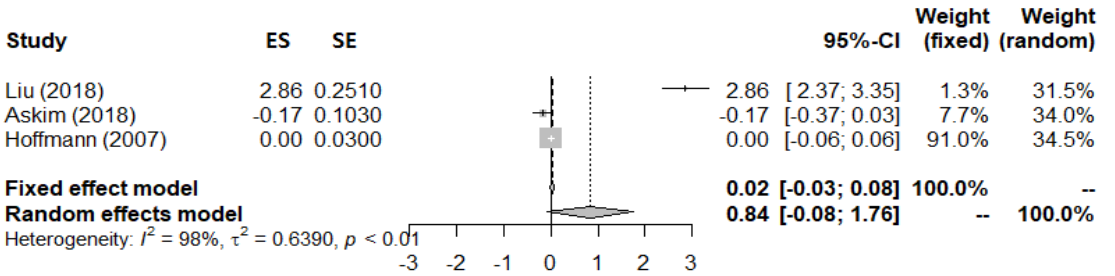
[Fig. 2] Forest plots of the effect of psychosocial intervention.

Depression effect sizes were calculated using a random effects model because the homogeneity test of depression studies showed a high level of heterogeneity (Q=71.72, p<.001, I2=79.1%). The overall effect size for depression was small with 0.39 (95% CI: 0.16-0.63) but statistically significant (Z=3.27, p=.001). Since Kerr, McCann, Mackey, and Wijeratne (2018) used two depression scales, both measurement values were included ([Fig. 2]).



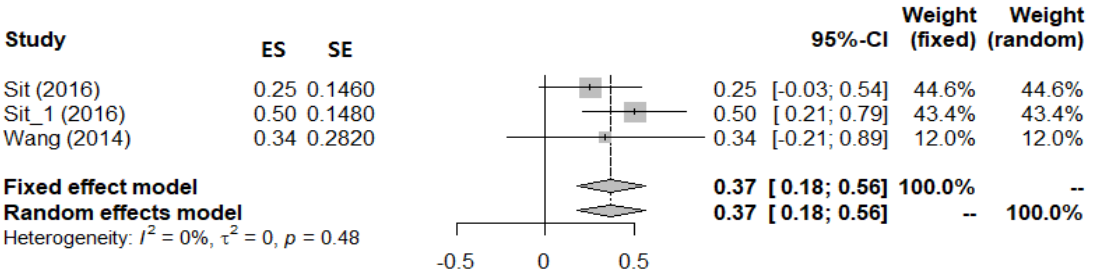
Q=1.11, df=6 (p=.980); Test for overall effect: Z=0.89 (p=.376)

(3A) The effect of behavioral therapy on physical function



Q=131.62, df=2 (p<.001); Test for overall effect: Z=1.79 (p=.073)

(3B) The effect of health education on physical function



Q=1.45, df=2 (p=.484); Test for overall effect: Z=3.81 (p<.001)

(3C) The effect of social support on physical function

[Fig. 3] Effect sizes of types of psychosocial intervention on physical function.

4.2 Psychosocial intervention type effect size

Three types of psychosocial interventions were used to improve physical function: behavioral therapy, health education, and social support. Behavioral therapy effect sizes were calculated using a fixed effects model (Q=1.11, p=.980). The overall behavioral therapy effect size on physical function was 0.08 (95% CI: -0.09-0.25), which was not statistically significant (Z=-0.89, p=.376). Health education effect sizes were calculated using a

random effects model (Q=131.62, p=.721, I2=98.5%). The overall effect size of health education on physical function was 0.84 (95% CI: -0.08-1.76), which was not statistically significant (Z=1.79, p=.073). Social support effect sizes were calculated using a fixed effects model (Q=1.45, p=.484). The overall effect size of social support on physical function was 0.37 (95% CI: 0.18-0.56), but statistically significant (Z=3.81, p<.001) ([Fig. 3]).

Four types of psychosocial interventions were used to treat depression: behavioral therapy, counseling, health education, and social support. Behavioral therapy effect sizes were calculated using a random effects model (Q=31.44, p<.001, I2=77.7%).

The overall effect size of behavioral therapy on depression was medium (0.61, 95% CI: 0.25-0.96) and statistically significant (Z=3.33, p<.001). Counseling effect sizes were calculated using a fixed effects model (Q=0.61, p=.435). The overall effect size of counseling on depression was 0.35 (95% CI: -0.11-0.80), which was not statistically significant (Z=1.49, p=.136). Health education effect sizes were calculated using a random effects model (Q=8.63, p=.035, I2=65.2%). The overall effect size of health education on depression was 0.26 (95% CI: -0.09-0.60), which was not statistically significant (Z=1.47, p=.143).

Social support effect sizes were calculated using a fixed effects model (Q=1.14, p=.285). The overall effect size of social support on depression was -.09 (95% CI: -0.31-0.12), which was not statistically significant (Z=-0.87, p=.386) ([Fig. 4]).

5. Publication bias in research

Funnel plots were used to test for publication bias. The plots were drawn and the degree of symmetry was visually examined, after which the Egger's regression test was performed to determine the statistical significance of the degree of symmetry. The results showed no risk of publication bias for depression (p=.462) or physical function (p=.160) ([Fig. 5]). The number of research papers required to reject the results of meta-analysis (Nfs) was 260 for depression and 112 for physical function.

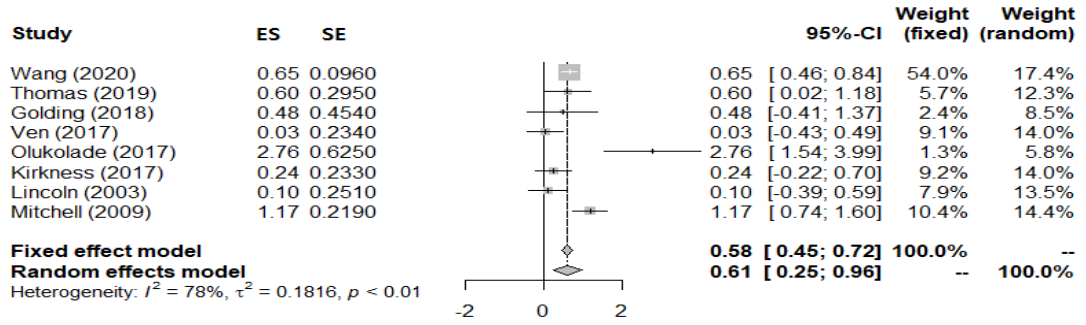
Ⅳ. Discussion

This study investigated the effects of psychosocial interventions on physical function and depression in stroke patients by systematically reviewing randomized controlled trials published between January 1990 and April 2020.

1. Characteristics and quality assessment of psychosocial interventions included in the systematic review

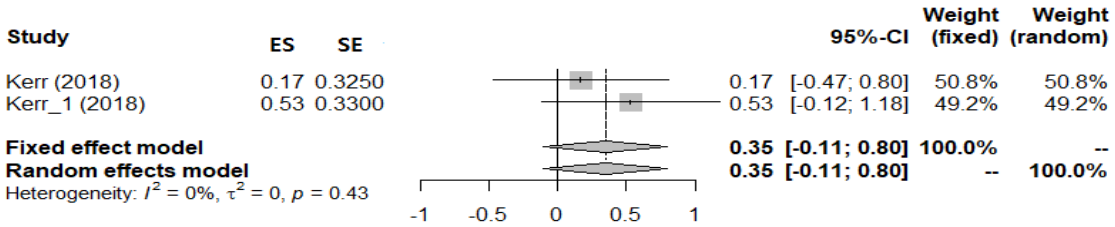
The systematic review showed that 51.8% of studies were conducted after 2016, 92.6% were conducted overseas, and 7.4% were conducted domestically. This finding shows that interest in stroke patient rehabilitation is steadily increasing, but domestic research on psychosocial interventions is still lacking compared to overseas research.

Behavioral therapy and health education were the most prevalent psychosocial interventions, employed with 48.1% and 29.6%, respectively. This finding is similar to a study on cancer patients that found behavioral therapies and health education were the most frequently used (Park and Bae, 2017). Behavioral therapies include cognitive therapies, relaxation therapies, and neurofeedback training, which are intervention methods for problem solving or coping. These are more frequently used as



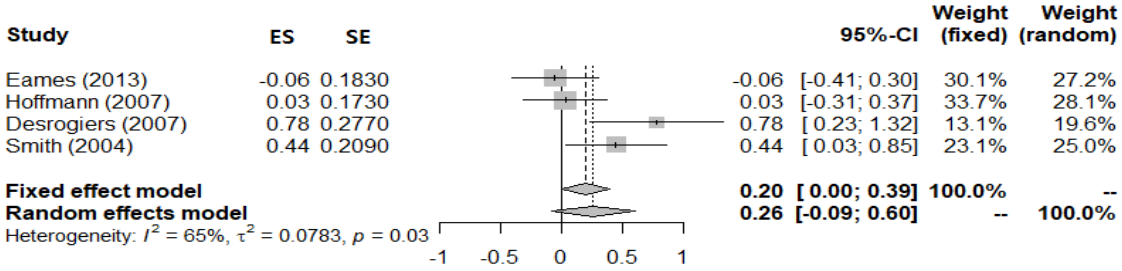
Q=31.44, df=7 (p<.001); Test for overall effect: Z=3.33 (p<.001)

(4A) The effect of behavioral therapy on depression



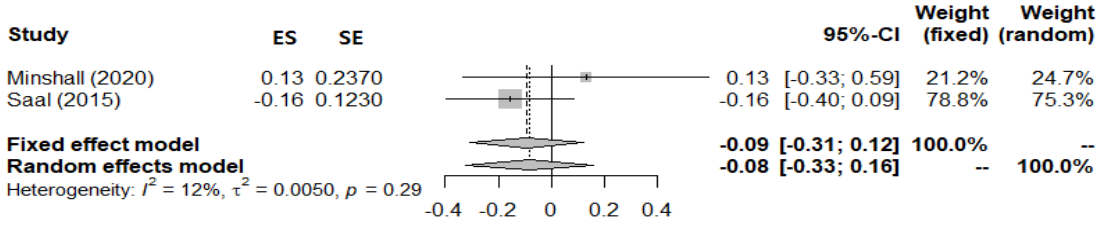
Q=0.61, df=1 (p=.435); Test for overall effect: Z=1.49 (p=.136)

(4B) The effect of counseling on depression



Q=8.63, df=3 (p=.035); Test for overall effect: Z=1.47 (p=.143)

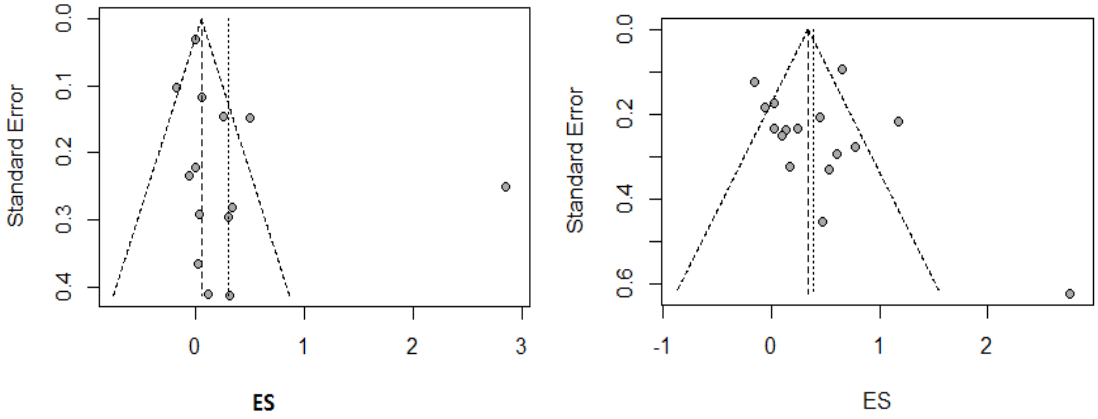
(4C) The effect of health education on depression



Q=1.14, df=1 (p=.285); Test for overall effect: Z=-0.87 (p=.386)

(4D) The effect of social support on depression

[Fig. 4] Effect sizes of types of psychosocial intervention on depression.



t=1.48, df=13 (p=.162); Nfs=112 (p<.001)
(A) Physical function

t=0.76, df=14 (p=.462); Nfs=260 (p<.001)
(B) Depression

[Fig. 5] Funnel plots of standard error by standardized mean difference.

interventions compared to counseling or social support because the goal of psychosocial interventions is to improve self-care ability by helping individuals develop confidence and motivation (Hoffman et al., 2012; Jang, 2013). Most studies on psychosocial interventions focused on individual rather than group interventions (77.7%). One previous study reported more effective depression reduction and physical function improvement through individualized interventions compared to group interventions (Huang et al., 2017). Kim et al.(2017) recommended individualized interventions in light of large individual differences in emotional states and physical function in recovering stroke patients. Accordingly, customized interventions that consider individual differences need to be actively developed.

The instruments most frequently used to measure psychosocial interventions outcomes included the BI (Barthel Index) for physical function and the HADS (Hospital Anxiety and Depression Scale) for depression. The BI is a highly reliable instrument that can identify disability severity by assessing stroke patients' physical function (Kwakkel et al., 2011) and is a recommended tool for discharge planning (Chen et al., 2013). It appears that regular physical function assessments using the BI and similar instruments may be helpful for determining stroke patients' discharge time and placement. The HADS is frequently used to measure patients' depression because of its simplicity, with only 14 items, and its high reliability and validity (80-90%) (Lam, Pan, Chan, Chan, and Munro, 1995). Since patients with post-stroke depression appear to have difficulty recovering their ability to independently perform ADLs, early screening and management of post-stroke depression is necessary.

The results of the methodological quality assessments of the 27 studies included in the systematic review showed that about 25% did not describe the exact method of random sequence generation, and about 40% did not describe allocation concealment. In addition, about 50% of studies did not clearly state whether participants and personnel

were blinded to the study purpose or outcome assessment. Given the characteristics of psychosocial interventions, the practicality of thorough participant and personnel blinding is limited. However, to investigate the net effect of psychosocial interventions, various blinding methods should be utilized. Both selective reporting and other potential biases were low in this study because results were presented according to an a priori protocol, which future studies should also consider employing.

2. Psychosocial intervention efficacy

This study found significant effects of psychosocial interventions on stroke patients' physical function and depression. Physical function improved significantly in patients who received psychosocial interventions despite a small effect size. This finding is consistent with the results of a previous meta-analysis that reported a small effect size for supportive home care intervention effects on physical function (Huang et al., 2017). Previous research also showed improvement in ADLs following psychosocial interventions, which were related to strengthening internal resources, such as self-efficacy (Sit et al., 2016). Patients' physical function deteriorates following a stroke, making it difficult to perform and adapt to daily activities (Carod-Artal, 2012). This, in turn, results in withdrawal from social activities. Accordingly, psychosocial interventions need to be actively used.

The studies showed that stroke patients' depression was also significantly reduced following psychosocial interventions, despite a small effect size. This is consistent with the medium effect size found for psychosocial interventions on stroke patients' depression (Huang et al., 2017). It is also supported by a previous study that reported decreased depression resulted from psychosocial interventions strengthening stroke patients' emotional control and self-awareness (Wang et al., 2020). Therefore, psychosocial interventions should be actively used to facilitate stroke patients' recovery and successful adaptation.

The analysis of psychosocial intervention effects by intervention type showed that social support significantly improved physical function, and behavioral therapy significantly reduced depression, despite both having small effect sizes. Previous studies reported that nurse-provided individualized face-to-face psychosocial support (Minshall et al., 2020) or interventions that strengthened self-management skills improved stroke patients' physical function (Sit et al., 2016; Chen et al., 2018). Social support for stroke patients may increase their participation in health management decisions and strengthen self-management behavior by providing information related to stroke, emotional support, and individualized health services (Sit et al., 2004). In addition, behavioral therapies, such as mindfulness mediation (Wang et al., 2020), behavioral reinforcement therapies (Thomas et al., 2019), and relaxation therapies (Golding et al., 2018), were found to be effective interventions for depression. Therefore, stroke patients' recovery may be supported through providing social support to improve their physical function and behavioral therapies to reduce depression.

This study had some limitations. First, unpublished research may have been excluded because publication years included in the searches were limited. Next, the long-term effects of psychosocial interventions were not examined because meta-analysis was performed using statistics obtained immediately after interventions. Third, changes in physiological parameters following psychosocial interventions were not examined because only self-reported outcome variables were used. Fourth, despite limiting inclusion to

randomized controlled trials, the heterogeneity of psychosocial intervention effects was high. This may have resulted from limitations in maintaining effect size homogeneity because of smaller standard errors in some studies than others, or the diversity in the types of psychosocial interventions. The significance of this study, however, lies in uncovering evidence that supports the effectiveness of psychosocial interventions on stroke patients' physical function and depression levels, including social support interventions for physical function and behavioral therapies for depression.

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