



Effectiveness of group cognitive behavioral therapy with mindfulness in end-stage renal disease hemodialysis patients

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Background: Many patients with end-stage renal disease (ESRD) undergoing hemodialysis (HD) experience depression. Depression influences patient quality of life (QOL), dialysis compliance, and medical comorbidity. We developed and applied a group cognitive behavioral therapy (CBT) program including mindfulness meditation for ESRD patients undergoing HD, and measured changes in QOL, mood, anxiety, perceived stress, and biochemical markers.

Methods: We conducted group CBT over a 12-week period with seven ESRD patients undergoing HD and suffering from depression. QOL, mood, anxiety, and perceived stress were measured at baseline and at weeks 8 and 12 using the World Health Organization Quality of Life scale, abbreviated version (WHOQOL-BREF), the Beck Depression Inventory II (BDI-II), the Hamilton Rating Scale for Depression (HAM-D), the Beck Anxiety Inventory (BAI), and the Perceived Stress Scale (PSS). Biochemical markers were measured at baseline and after 12 weeks. The Temperament and Character Inventory was performed to assess patient characteristics before starting group CBT.

Results: The seven patients showed significant improvement in QOL, mood, anxiety, and perceived stress after 12 weeks of group CBT. WHOQOL-BREF and the self-rating scales, BDI-II and BAI, showed continuous improvement across the 12-week period. HAM-D scores showed significant improvement by week 8; PSS showed significant improvement after week 8. Serum creatinine levels also improved significantly following the 12 week period.

Conclusion: In this pilot study, a CBT program which included mindfulness meditation enhanced overall mental health and biochemical marker levels in ESRD patients undergoing HD.

Keywords: Cognitive behavioral therapy, Depression, Mindfulness, Quality of life, Renal dialysis

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Introduction

Many patients with end-stage renal disease (ESRD) are faced with lifestyle restrictions in diet, fluid intake, and medication. They must also adhere to hemodialysis (HD) or peritoneal dialysis schedules. Therefore, they often feel they have lost control of their lives and experience poor quality of life (QOL) [1,2]. These feelings induce non-adherence to medical guidelines, which may exacerbate medical problems [1].

The rate of non-adherence to diet, fluid intake, and medication regimens has been reported to range from 30% to 60% in ESRD patients receiving dialysis [1]. Depression is common in ESRD patients (20–30%) [3,4], and causes reduced QOL [5,6], poor adherence to dialysis treatment [7], and increased mortality [8] and suicidality [9].

Pharmacological intervention for depression is ineffective for many ESRD patients [10]; therefore, non-pharmacological interventions have been used to treat psychiatric problems including depression. Strategic self-presentation, kidney disease education, supportive psychotherapy, and group intervention have been shown to reduce depression and progression of renal disease [11–15]. Individual cognitive behavioral therapy (CBT) has been shown to improve depressive mood and QOL [12]. Mindfulness-based cognitive therapy (MBCT) [16], which is related to mindfulness-based stress reduction (MBSR) [17], also shows efficacy in preventing relapse of depression. MBSR can enhance adaptation to distress from chronic illness, and has a strong potential for benefit for ESRD patients [17]. A previous study described telephone-adapted MBSR for patients awaiting kidney transplantation [18], but few studies have applied MBSR or MBCT to patients with ESRD.

Patients with ESRD need intervention focused on their psychological characteristics to reduce medical non-adherence. Individual CBT programs are difficult to apply in clinical settings due to lack of time and the limited number of experts available. Therefore, in this pilot study, we developed a 12-week group CBT program that included mindfulness meditation, anger management, and communication skills training based on conventional CBT [19]. We measured overall QOL, mood, anxiety, and distress in ESRD patients undergoing HD and suffering from depression, at baseline and after eight and 12 weeks of

group CBT to evaluate its effectiveness and feasibility.

Methods

Participants

Seven participants (three women and four men) were enrolled in the study. Due to their HD schedules, we divided them into three groups of 2 to 3 participants each. Participants completed 12 one-hour sessions with the same psychologist once a week in the same room. All participants underwent HD for four hours, three times per week. Participants were patients at the SMG-SNU Boramae Medical Center and at one local clinic connected to this center. Inclusion criteria were age ≥ 20 years, ESRD treatment with HD for ≥ 3 months, Beck Depression Inventory (BDI-II) score ≥ 15 , and major depressive disorder diagnosed by a single psychiatrist according to the Diagnostic and Statistical Manual of Mental Disorders 4th edition, text revision (DSM-IV-TR) [20]. Exclusion criteria were HD due to acute renal failure, current hospitalization, current ongoing chemotherapy or radiotherapy, kidney transplantation planned within a few months, cognitive dysfunction or mental retardation, current substance abuse, lack of fluency in Korean, and current use of psychotropic medication.

This study was approved by the Institutional Review Board of the SMG-SNU Boramae Medical Center (IRB No. 16-2013-71). Informed consent was obtained from all participants after providing full information about the study. This study was registered on ClinicalTrials.gov (NCT02011139).

Organization of the CBT program (Table 1)

We modified the conventional CBT program because patients with ESRD have unique psychological characteristics. We organized the CBT program into three parts: In the initial phase (sessions 1–3), the program included an introduction, motivation, and muscle relaxation. In this phase, to raise participants' motivation, we helped them set goals and provided information on the influence of stress on the body. Muscle relaxation included preparation for mindfulness meditation in the next phase. In the middle phase (sessions 4–7), skills for controlling negative feelings and pain were included with a body scan

Table 1. Summary of group cognitive behavioral therapy (CBT) themes

Session	Contents
1	Introduction of CBT program, therapist, and group members
2	Talking about stress regarding chronic kidney disease and hemodialysis Understanding of stress and depression Progressive muscular relaxation
3	Finding values Setting goals Progressive muscular relaxation
4	Recognizing automatic thinking and relationship between thinking and emotion Body scan practice
5	Mindfulness meditation I (breathing)
6	Mindfulness meditation II (movement)
7	Self-soothing techniques: self-comfort for experiencing positive feelings
8	Anger management
9	Effective communication skills I (introduction)
10	Effective communication skills II (practicing): delivery of feeling, needs, favor
11	Effective communication skills III (practicing): listening, compromising, acceptance
12	Summary of the program themes Making goals Planning for stress management

and mindfulness meditation [16,21]. In this phase, we encouraged participants to identify automatic thinking related to their emotions. The mindfulness meditation was divided into two parts: breathing and movement [16]. Through the meditation and self-soothing techniques, we helped participants overcome obsession with physical pain or automatic thinking and encouraged positive feelings. In the final phase, social skills training was included with anger management. For effective communication with their caregivers or medical staff, we included conversation skills training and practice in common situations with other participants [15,22]. To increase participants' motivation and program effectiveness, we included a brief homework assignment between every session. We administrated the program once a week with the same psychologist.

Assessment measures

Except for self-rating questionnaires, all assessments were performed by a single psychiatrist who did not attend group CBT. Assessments were made on the same day as CBT, before the first and eighth sessions, and after the 12th session. Participants underwent HD after each group CBT. We evaluated QOL using the World Health Organization QOL assessment, WHOQOL-BREF [23]. WHOQOL-BREF total score was the sum of physical, psychological, social, and environmental domains, and two general items. Higher scores indicate better QOL. Depressive symptom severity was measured using BDI-II [24], a self-rating assessment, and by the Hamilton Rating Scale for Depression (HAM-D) [25], rated by a clinician. The BDI-II assessment has 21 items with a maximum score of 63, and the HAM-D assessment has 17 items with a maximum score of 52; higher scores indicate more severe depression. To evaluate anxiety and stress, participants completed the Beck Anxiety Inventory (BAI) [26] and 10 items of the Perceived Stress Scale (PSS) [27]. BAI is a self-reported questionnaire of 21 items on a four-point Likert scale, where a higher score indicates more severe anxiety. PSS is also a self-reported survey on a four-point Likert scale, where a higher score indicates a more stressful state. The Temperament and Character Inventory (TCI) [28] was included at baseline to evaluate the patients' characteristics before group CBT. TCI is a self-rated assessment consisting of 240 yes-no questions. It has seven dimensions, including four traits (novelty seeking, NS; harm-avoidance, HA; reward-dependence, RD; and persistence, PE) and three characteristics (self-directedness, SDT; cooperativeness, CO; and self-transcendence, ST). Higher scores indicate that the participant has a greater degree of the specific characteristic, with a score of ≥ 55 classified as High, ≤ 45 as Low, and others as Medium, according to the TCI manual [28].

We evaluated the biochemical variables, Kt/V, albumin, serum creatinine (sCr), calcium/ phosphorus (Ca/P), and interdialytic weight gain (IDWG), before and after 12 weeks of group CBT.

Statistical analysis

Generalized estimating equations (GEE) were used to compare BDI-II, HAM-D, BAI, PSS, and WHOQOL-BREF

scores across the 12-week period. GEE have the benefit of analyzing correlations of repeated results within-subject. We used the Wilcoxon signed-rank test to compare biochemical marker levels before and after group CBT. All statistical analyses were performed using IBM SPSS Statistics ver. 20.0 (IBM Co., Armonk, NY, USA).

Results

The demographic characteristics of the participants are summarized in Table 2. Mean age was 56.4 ± 7.9 years (range, 48–67 years), mean education level was 10.4 ± 2.5 years (range, 6–13 years), and only one participant had a current occupation. Four participants had diabetes mellitus as the main underlying disease related to HD; other underlying diseases were hypertension or other/unknown cause. Although most of the participants had combined medical diseases including chronic lung disease, peptic ulcer, cerebrovascular disease, and coronary artery disease, their overall physical states were stable during CBT. Mean dialysis vintage was 2.5 ± 0.6 years (range, 1.7–3.5 years). One participant had a history of kidney transplantation.

At baseline, mean Kt/V was 1.3 ± 0.2 (range, 1.0–1.6); serum albumin was 4.0 ± 0.3 g/dL (range, 3.7–4.7 g/dL); sCr was 11.5 ± 3.5 mg/dL (range, 7.4–17.2 mg/dL); Ca/P was 8.4/5.1 ± 0.5/2.2 mg/dL (range, 7.5/2.7–8.8/8.7 mg/dL); IDWG was 2.6 ± 0.6 kg (range, 1.5–3.0 kg) (Table 2).

Before group CBT, participants had moderate to severe depressive moods as measured by self-rating (BDI-II; mean score, 32.0 ± 8.1; range, 22–43) and clinician rating (HAM-D; mean score, 19.4 ± 4.4; range, 14–26) (Fig. 1). The mean total QOL score measured by WHOQOL-BREF was 61.9 ± 11.3 (range, 48–82). Anxiety levels were mild (BAI; mean, 14.0 ± 10.4; range, 0–27), and stress levels were moderate (PSS; mean, 19.4 ± 7.1; range, 9–28). In the TCI, participants showed high HA (mean, 57.4 ± 11.4; range, 41–69), low RD (mean, 42.0 ± 10.1; range, 28–54), low SDT (mean, 41.4 ± 11.4; range, 25–56), and low CO (mean, 42.9 ± 4.4; range, 38–52) (Fig. 2).

After participants completed all 12 CBT sessions, mean Kt/V was 1.5 ± 0.3 (range, 1.2–2.0); serum albumin was 4.0 ± 0.2 g/dL (range, 3.8–4.3 g/dL); sCr was 10.3 ± 2.7 mg/dL (range, 7.2–13.5 mg/dL); Ca/P was 8.8/4.9 ± 0.6/1.0 mg/dL (range, 7.9/3.5–9.7/6.5 mg/dL); and IDWG was 2.4 ± 0.7 kg (range, 1.5–3.0 kg). In a Wilcoxon signed-

Table 2. Demographic data and biochemical variables during the group cognitive behavioral therapy (CBT)

Participant	Sex /age (yr)	Education (yr)	Occupation	Main disease associate HD	Previous KT	Dialysis vintage (yr)	Kt/V		Albumin (g/dL)		sCr* (mg/dL)		Ca/P (mg/dL)		IDWG (kg)	
							Before	After	Before	After	Before	After	Before	After	Before	After
A	F/65	9	No	Others	No	3.0	1.3	1.3	3.9	3.9	14.3	8.8/2.7	8.8/4.1	2.5	3.0	
B	F/67	9	No	Unknown	No	2.4	1.6	2.0	3.9	3.8	8.9	8.8/3.0	8.1/3.5	1.5	1.5	
C	M/55	6	No	DM	No	2.1	1.3	1.7	3.7	4.1	9.7	7.5/8.7	8.8/6.0	3.0	3.0	
D	M/61	12	No	DM	Yes	2.0	1.1	1.5	3.7	3.8	9.9	8.5/3.6	7.9/4.6	3.0	3.0	
E	M/49	12	Yes	HTN	No	1.7	1.2	1.2	4.7	4.3	13.2	8.8/4.7	9.3/4.7	4.0	2.8	
F	F/50	13	No	DM	No	3.5	1.5	1.5	4.1	4.2	7.4	8.1/6.0	9.7/6.5	4.0	1.8	
G	M/48	12	No	DM	No	2.5	1.0	1.4	4.1	3.9	17.2	8.2/6.9	9.2/4.6	2.5	2.0	

Ca/P, calcium/phosphorus; DM, diabetes mellitus; F, Female; HD, hemodialysis; HTN, hypertension; IDWG, interdialytic weight gain; KT, kidney transplantation; M, male; sCr, serum creatinine.

Before, before group CBT; After, after group CBT.

*P = 0.043 by Wilcoxon signed ranks test.

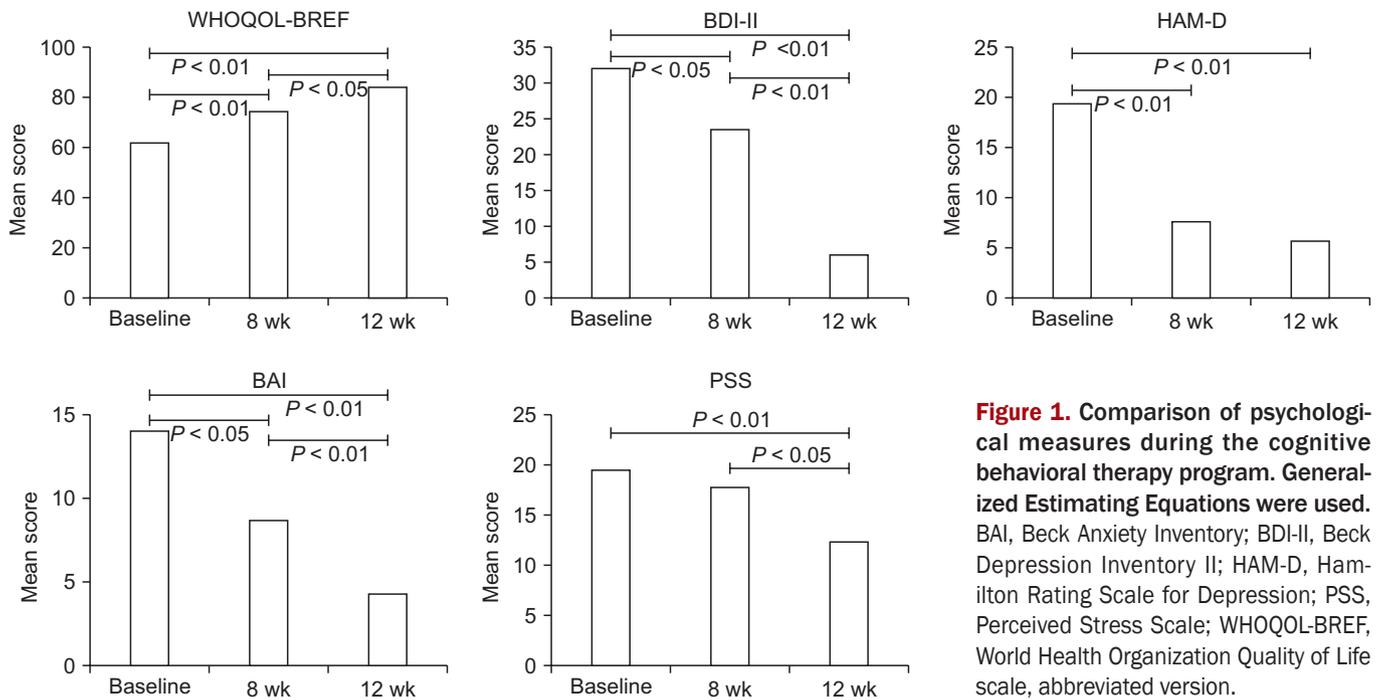


Figure 1. Comparison of psychological measures during the cognitive behavioral therapy program. Generalized Estimating Equations were used. BAI, Beck Anxiety Inventory; BDI-II, Beck Depression Inventory II; HAM-D, Hamilton Rating Scale for Depression; PSS, Perceived Stress Scale; WHOQOL-BREF, World Health Organization Quality of Life scale, abbreviated version.

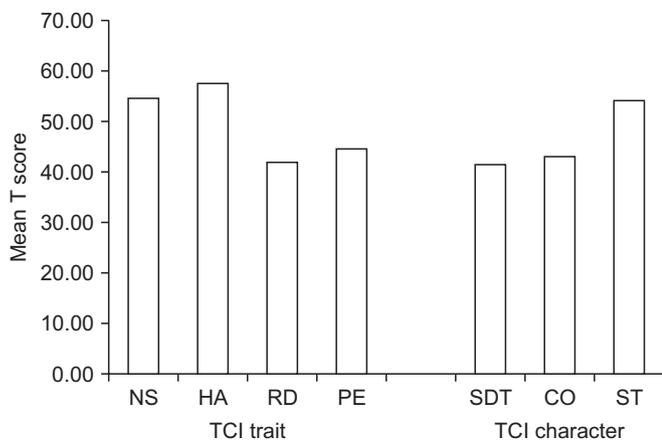


Figure 2. Personality dimensions of the participants (mean T scores of participants at baseline).

CO, cooperativeness; HA, harm-avoidance; NS, novelty seeking; PE, persistence; RD, reward-dependence; SDT, self-directedness; ST, self-transcendence; TCI, Temperament and Character Inventory.

rank test, Kt/V and sCr showed significant improvement ($P = 0.063$ and 0.043 , respectively). Other variables did not show a significant change (Table 2).

Participants showed significant improvement in all rating scores compared to baseline (Fig. 1). QOL by WHOQOL-BREF showed significant improvement (mean, 84.1 ± 8.7 ; range, 71–92; $P < 0.001$). In mood scales, both BDI-II and HAM-D scores significantly decreased to normal or

minimal depressive levels (BDI-II: mean, 6.1 ± 3.8 ; range, 2–12; $P < 0.001$ and HAM-D: mean, 5.7 ± 1.5 ; range, 4–8; $P < 0.001$). BAI and PSS scores also showed significant improvement after 12 weeks of group CBT (BAI: mean, 4.3 ± 3.4 ; range, 0–8; $P < 0.001$ and PSS: mean, 12.3 ± 3.0 ; range, 7–16; $P < 0.001$). WHOQOL-BREF scores and the self-rating BDI-II and BAI scales showed significant improvement continuously across the 12 weeks. HAM-D scores showed significant improvement by week 8; PSS showed significant improvement after week 8 (Fig. 1).

Discussion

After our 12-week group CBT program, ESRD patients undergoing HD showed significant improvements in WHOQOL-BREF, BDI-II, HAM-D, BAI, and PSS scores, and in sCr levels. WHOQOL-BREF, BDI-II, and BAI scores showed continuous improvement at each evaluation over the 12-week period. HAM-D scores improved at week 8 but not during last four weeks; PSS scores showed significant improvement after week 8.

We suspect that these results are related to the themes of the CBT program. Until the second evaluation period (starting at week 8), patients experienced mainly mindfulness meditation, correction of automatic thinking, and self-soothing techniques. Scores on objective mood

(HAM-D) showed significant improvement in depressive symptoms starting at week 8, after the second period containing conventional CBT and mindfulness meditation. We expect that, with the accumulated effect of prior sessions, the terminal themes of the program such as anger management and communication skills help participants gain feelings of self-control, and these feelings might improve perceived stress. For QOL and subjective improvement of depression and anxiety, we think that most themes of our group CBT program might be helpful.

Mean baseline scores of BDI-II and HAM-D were 32 ± 8.10 and 19.43 ± 4.43 , respectively. These scores are much higher than the suggested cut-off values for depression for ESRD patients undergoing HD in other studies ($14-16$ for BDI [22], and 10 for HAM-D [29]). The mean total score on the WHOQOL-BREF in our participants was 61.9 ± 11.3 at baseline. This score was similar to or higher than scores reported in other studies of elderly patients with chronic kidney disease or depression [30,31]. Compared with a QOL study of chronic kidney disease patients, our patients reported relatively low social domain and high environmental domain scores. We suppose that our patients' relatively severe depressive symptoms and regular HD schedule might have caused a lower social domain score, while a stable national medical insurance and care system for ESRD in Korea might have caused a higher environmental score.

In TCI, participants showed high HA and low RD in trait dimensions and low SDT and low CO in character dimensions. High HA, low SDT, and low CO are related to depression [32]. Therefore, our participants had traits and characteristics consistent with depression. Throughout our program, they reported improvement of mood and QOL.

It is common for ESRD patients undergoing HD to experience low QOL, feelings of loss of control in their lives, depressive mood, and anxiety. These feelings often induce non-adherence to medical treatment [33]. In this study, improvement of the biochemical variables sCr and Kt/V suggests that our program induced better medical adherence. A previous study also reported improved IDWG following conventional CBT [12].

The main psychological mechanism in which mindfulness meditation reduces psychiatric problems including depression is re-perceiving [34,35]. In mindfulness practice, moment-by-moment nonjudgmental awareness is

essential. Through nonjudgmental awareness, one re-perceives problems with objectivity and greater clarity [35]. This process helps one to control unpleasant sensations. This process is also related to self-regulation, decreased emotional reactivity, clarification of values, and cognitive-behavioral flexibility. Self-regulation provides coping skills and prevents maladaptive responses. Cognitive and behavioral flexibility induce adaptive responses. Values clarification facilitates choosing behaviors more congruent with one's core values [34,35]. It has been reported that mindfulness is related to cortical midline structures (CMS), the amygdala, anterior insula, and lateral prefrontal cortex [35]. As the CMS is involved in emotional processing, this structure may have a role in self-referential thinking and emotional dysregulation in mood disorders [35,36]. Modifying the CMS has been suggested to be one of the key mechanisms of mindfulness [35].

We developed a group CBT program for ESRD patients undergoing HD who experience depression that addressed the patients' psychological character. In our program, patients experienced psychoeducation, correction of automatic thinking, mindfulness meditation, and communication skills practice. As a result, participants showed significant improvements in QOL, depressive mood, anxiety, perceived stress, and biochemical marker levels. In a clinical situation, this group CBT program would be helpful for all depressive patients, especially those who cannot take psychiatric medications due to physical conditions or who show no significant improvement following medication. We expect that it would be easier to manage such a program if group members have a similar age and educational level.

Although our group CBT program was feasible and effective, some limitations exist. First, the sample size was small. Second, our participants had less comorbid illness and more medical stability than many other patients with ESRD. Additionally, we used small groups of 2 to 3 participants. These characteristics may have affected participant compliance and improvement. Third, this study was not controlled and did not use a blinded test. Fourth, we did not carry out a longitudinal follow-up after our group CBT program and therefore could not confirm the long-term effect. In the future, a randomized controlled study with a larger sample size and long-term observation will be needed.

In conclusion, our group CBT program, including

mindfulness meditation and practical distress-relieving methods such as self-soothing, anger management, and communication skills practice in the framework of conventional CBT, was feasible and effective. Our program was applied to chronic ESRD patients undergoing HD and resulted in improvement in overall psychiatric problems such as low QOL, depressive mood, anxiety, and stress, which might influence patients' medical compliance.

Conflicts of interest

All authors had no conflicts of interest to declare.

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