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EVALUATION OF DEPRESSION AND SLEEP QUALITY IN PATIENTS WITH SOLID TUMOR DURING CHEMOTHERAPY

Original Article

SOLİD TÜMÖRÜ OLAN HASTALARDA KEMOTERAPİ SIRASINDA UYKU KALİTESİ VE DEPRESYONUN DEĞERLENDİRİLMESİ

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ABSTRACT

Cancer is a stressful situation itself and brings along a number of psychiatric disorders, which are frequently encountered as depression and sleep disorders. The purpose of this study was to evaluate the depression and sleep quality in cancer patients receiving chemotherapy. 123 cancer patients receiving chemotherapy at Sakarya University Faculty of Medicine Training and Research Hospital were evaluated by questionnaire. Beck Depression Inventory (BDI) and Pittsburgh Sleep Quality Index (PSQI) were used to obtain data of the study. Major depression was detected in 12.2% of the patients by Beck depression inventory, while there was moderate depression in 27.6% and mild depression in 31.7% of the patients. Poor sleep quality was present in 63.6% of the patients according to Pittsburgh sleep scale. This study showed that patients with solid tumor receiving chemotherapy in our unit had higher rates of both depression and sleep quality disorder compared to literature.

Keywords: *Depression;sleep quality; solid tumor; chemotherapy.*

ÖZET

Kanser başlı başına bir stres halidir ve pek çok psikiyatrik hastalığı beraberinde getirir. En sık görülenler depresyon ve uyku bozukluklarıdır. Bu çalışmada kemoterapi alan kanser hastalarında depresyon ve uyku kalitesinin değerlendirilmesi amaçlandı. Bu çalışma Sakarya Üniversitesi Tıp Fakültesi Eğitim ve Araştırma Hastanesi Onkoloji polikliniği tarafından takip edilen ve kemoterapi alan 123 kanser hastasının anket değerlendirilmesi sonucunda yapıldı. Veriler Beck Depresyon Ölçeği (BDÖ) ve Pittsburg Uyku Kalitesi İndeksi ölçeği (PUKİ) kullanılarak elde edildi. Beck depresyon ölçeğine göre hastaların %12,2'sinde major depresyon, %27,6'sında orta derecede depresyon, %31,7'sinde hafif derecede depresyon saptandı. Hastaların uyku durumu Pittsburg uyku ölçeği analiz edildiğinde %63,6'sında uyku kalitesinin bozuk olduğu saptandı. Bu çalışma ünitemizde kemoterapi alan solid tümörlü hastalarımızda gerek depresyon gerekse uyku kalitesi bozukluğu oranlarının literatüre oranla yüksek olduğunu gösterdi.

Anahtar Kelimeler: *Depresyon; uyku kalitesi;solid tümör; kemoterapi.*

INTRODUCTION

Cancer is a serious health problem that might substantially cause death, unless it is treated with early diagnosis. Cancer is the second most common cause of death following the ischemic heart diseases among all deaths (1,2).

Chemotherapy, radiotherapy, surgery, immunotherapy, and targetted therapies are treatment methods used in the cancer treatment and they could be used either alone or in a combined way according to the type, molecular structure, stage of cancer and physical performance of the patient. The iam is to extend the life expectancy of patients and increase their life quality with the help of these treatment methods. However, patients experience a number symptoms such as anxiety, depression, pain, sexual dysfunction, fatigue and changes in self-conception due to the side effects of chemotherapy such as hair loss, skin changes, nausea, vomiting and due to the effects of various biological substances released by cancerous cells. This results in destroyed future plans and expectations (3). Primarily, cancer is a stressful situation itself as it causes patients to feel very close to death and it changes normal routine of almost entire life (4). Thus, cancer patients have a high prevalence of psychiatric disorders (35-50%) (5). The most frequent psychopathology is major

depression (MD) (5-7). A number of studies have demonstrated that depression has an unfavorable effect on response to treatment and natural course of disease in cancer patients (5-7).

Since the clinical symptoms of cancer and the side effects of chemotherapy might cause complaints that may mimic depressive symptoms, it is required to differentiate the cancer related medical problems from depression (8).

Sleep disorders are among the most frequent side effects encountered in cancer patients. Sleep is affected by a number of conditions such as various biochemical substances released as a result of the growth of tumor, drugs and methods used in cancer treatment and undesirable conditions caused by cancer or nausea (9).

Depression and sleep disorders negatively affect the quality of life of cancer patients. When they are treated, a positive impact is obtained in the quality of life, the response to treatment and even survival (4,9,10).

This study was designed to evaluate the depression and sleep qualities of cancer patients treated and followed up in our institution during the chemotherapy period.

MATERIAL AND METHOD

Patients receiving chemotherapy in the chemotherapy unit of Sakarya University Training and Research Hospital between May 2012 and January 2013 who were older than 18 years of age and agreed to fill out a questionnaire were enrolled into the study. Patients were eligible for the study if they have both physical and mental sufficiency to conduct the interview, receive no psychiatric medicine and not in terminal stage of cancer. Of the 227 patients receiving chemotherapy during this period, 123 of them were eligible for the study. Patients of outpatient clinic were informed about the study and Beck Depression Inventory (BDI) and Pittsburgh Sleep Quality Index (PSQI).

Pittsburgh Sleep Quality Index (PSQI)

PSQI is a questionnaire involving 19 questions which evaluate the sleep quality, amount of the sleep, the existence and severity of sleep disorder in the individual for the last one month. It involves seven items evaluating the subjective sleep quality, sleep delay, sleep duration, sleep efficiency, sleep disorder, use of sleeping pills and disruption in daily functions. The response of each is scored between 0-3 according to the symptom frequency. The scoring is as follows; 0 if none happened throughout the previous month, 1 if it is less than once a week, 2 if once or twice a week and 3 if three times and more a week. The evaluation of sleep quality asked in the questionnaire is scored as follows; 0 very good, 1 highly good, 2 highly bad and 3 very bad. The global score obtained varies between 0 and 21. When the global score is 5 and above, this indicates that the sleep quality is clinically and significantly at a low level. The diagnostic sensitivity is 89.6% and its specificity is 86.5% (11,12) .

Beck Depression Inventory (BDI)

It is a self- assessment scale involving a total of 21 items. It provides a 4-point likert measurement. Each item obtains a gradually increasing score between 0-3 and the total score is obtained by summing them. The evaluations in the scale scoring are as follows: 0-10 no depression, 11-17 mild depression, 18-23 moderate depression and 24 and above major depression. It could discern depression and other psychopathologic conditions. The scale was tested in terms of efficiency and reliability by Hisli (1989) in Turkey and it was emphasized that patients who obtained a score of 17 and above are needed to be treated (13,14).

As a result of the study, patients meeting the criteria of depression

according to BDI were referred to the psychiatry clinic for confirmation and treatment of depression. SPSS 17.0 statistics program was used to assess the data. Descriptive statistical methods were used in the analysis of the data obtained from patients.

FINDINGS

Of patients who were involved in the study, 48% were male and 52% were female. Their mean age was determined as 56.6±12.4. **Table 1**

Parameter	n (total: 123)	%
Median age(min-max)	58 (24-83)	
Gender		
Male	59	48
Female	64	52
Beck Depression Inventory		
No Depression	35	28.5
Mild Depression	39	31.7
Moderate	34	27.6
Major Depression	15	12.2
Pittsburgh Sleep Scale		
Pittsburgh Sleep Scale ≥5	49	63.6
Pittsburgh Sleep Scale <5	28	36.4

Table 1. *Demographic characteristics, depression and sleep quality data of patients receiving chemotherapy.*

illustrates the data about the demographic features, depression and sleep quality of patients. The most common cancers in decresing frequency were as follows: breast, invasive, ductal, carcinoma, lung adenocarcinoma, colon adenocarcinoma, rectum adenocarcinoma, and gastric adenocarcinoma (**Table 2**).

Cancer location	n (total: 123)	%
Breast	37	30.0
Lung	26	21.4
Colon	16	13
Rectum	12	9.9
Stomach	10	8.2
Over	3	2.4
Bladder	3	2.4
Larynx	3	2.4
Prostate	2	1.6
Soft tissue	2	1.6
Gall bladder	2	1.6
Pancreas	2	1.6
Other (Ureter, skin, endometrium, brain, adrenal	5	4

Table 2. *Primary site of the cancer in patients involved in the study.*

According to BDI, major depression was determined in 12.2% of patients, moderate depression in 27.6%, mild depression in 31.7% and no depression in 28.5%. According to the PSQI analysis, 63.6% of the patients had a poor sleep quality.

DISCUSSION

Cancer is a chronic disease that causes pain, reminds of death, and creates a sense of guilt, anxiety, panic and complexity. It apparently is very difficult to cope with a serious disease that involves a long-term pain, sorrow, physical and functional loss, desperation, as well as a number of symptoms and effects (15). Regardless of the primary site, cancer is a disease that negatively affects the human life. The excess emotional stress experienced by patients during the diagnosis, as well as treatment and the lack of psychological support increase the tendency to depression and impairment of sleep quality. The literature frequently reports the coexistence of cancer and depression (1,16-19).

Being unable to identify the depression and delaying treatment decreases the quallity of life of the patients, decrease the compliance to anti-cancer treatment, and decreases our success in cancer treatment.

The prevalence of mental disorders in cancer patients was determined as 29-47% (20). In a study conducted in Italy for eight years involving ten thousand patients, it was demonstrated that the coexistence of major depression and cancer increased the risk of death (21). In another study, major depression was determined in 13% of 60 cancer patients and psychiatric morbidity was significantly higher in patients who knew they had cancer (22). In a study that was conducted with 117 patients in Turkey, psychiatric disorder was determined in 30% of patients and it was observed that 54.7% of patients were not aware of their disease (23). In the current study, mild, moderate or major depression was detected in 71.5% of the patients. This rate was considerably higher than the estimated rate in the literature. This can be due to higher rate of metastatic and heavily pre-treated patients in our study.
Sleep disorders could be encountered as insomnia, having a difficulty in falling asleep, frequent wake ups in the night, waking towards the morning and being unable to fall asleep again and the excessive desire of sleeping. Sleep disorders are prevalent in cancer patients and are associated with bad prognosis. In literature the prevelance of sleep disorders is 50%-60% in cancer patients (24). The systemic review by Howell et al, evaluating a 8-year database, 3 clinical practice manuals, 12 randomized controlled studies and a number of evidence-based methods emphasized that sleep disorder is a prevalent disorder in cancer and this problem requires more clinical studies to be solved (24).

Recent studies have demonstrated that sleep disorder, fatigue, and depressive mood are encountered more frequently in patients receiving chemotherapy. These disorders are actually associated with one another and their early diagnosis and treatment allow the solution of other problems, as well (25).

The fact that our study determined the depression at a higher level than the literature clearly presents the necessity for the support of specialist psychologists and/or psychiatrists in our oncology clinics. In addition poor sleep quality was highly prevelant (63.6%) in patients receiving chemotherapy. This study showed that patients with solid tumor receiving chemotherapy had higher rates of both depression and sleep quality corruption. The application of these highly reliable tests are undemanding in outpatient clinics and may enable the diagnosis of depressive diseases and sleep disorders in patients without symptoms. The appropriate treatment of depression and sleep may increase the adherence and success of chemotherapy, which may result in increase of the survival of the patients.

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EPICARDIAL FAT THICKNESS IN HEMODIALYSIS PATIENTS

Original Article

HEMODİYALİZ HASTALARINDA EPİKARDİYAL YAĞ DOKUSU KALINLIĞI

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ABSTRACT

Background: Cardiovascular disease (CVD) is the main cause of mortality in hemodialysis (HD) patients. Epicardial fat tissue (EFT) is a new risk factor in CVD. The aim of this study was to determine EFT thickness in HD patients.

Methods and results: We performed a cross- sectional study including 71 chronic HD patients and 65 age and sex-matched healthy controls. EFT was measured by using transthoracic Doppler echocardiography. EFT was found to be significantly higher in HD patients when compared to healthy controls (6.53 ± 1.01 mm vs. 5.79 ± 1.06 mm respectively, $p<0.001$).

Conclusion: This study demonstrated that EFT was significantly higher among HD patients compared to healthy controls. EFT thickness measured by TTDE could be a useful marker for CVD risk assessment in HD patients.

Key words: *Epicardial fat tissue; hemodialysis; cardiovascular disease.*

ÖZET

Giriş ve Amaç: Hemodiyaliz hastalarında kardiyovasküler hastalıklar mortalitenin en önemli nedenidir. Son yıllarda kardiyovasküler hastalık gelişiminde etkili yeni risk faktörü olarak epikardiyal yağ dokusu tanımlanmıştır. Çalışmamızda kardiyovasküler hastalık gelişim riski yüksek olan hemodiyaliz hastalarında epikardiyal yağ dokusunun kalınlığının ölçümü hedeflenmiştir.

Metod ve sonuçlar: Çalışmamıza 71 kronik hemodiyaliz hastası ve cinsiyet ile yaş eşleştirilmiş 65 sağlıklı kontrol dahil edilmiştir. Epikardiyal yağ okusu, transtorasik Doppler ekokardiyografi (TTDE) ile değerlendirilmiştir. Sonuçta hemodiyaliz hasta grubunda epikardiyal yağ dokusu kalınlığının kontrol grubuna gore anlamlı olarak artmış olduğu

saptanmıştır (6.53 ± 1.01 mm vs. 5.79 ± 1.06 mm respectively, p<0.001).

Özet: Çalışmamızda hemodiyaliz hastalarında epikardiyal yağ dokusu kalınlığının anlamlı olarak arttığı saptanmıştır.Hemodiyaliz hastalarında TTDE ile epikardiyal yağ dokusu kalınlığının ölçümü , bu hasta grubunda kardiyovasküler risk tayininde anlamlı olabilir.

Anahtar kelimeler: *Epikardiyal yağ dokusu; hemodiyaliz; kardiyovasküler hastalık.*

INTRODUCTION

Atherosclerotic cardiovascular disease (CVD) is the most common cause of mortality in hemodialysis (HD) patients (1,2). In addition to classical risk factors, left ventricular hypertrophy, coronary artery calcification, hyperparathyroidism, chronic inflammation and endothelial dysfunction (ED) have all been associated with CVD in HD patients (3-5).

Epicardial fat tissue (EFT) is the visceral adipose tissue surrounding the subepicardial coronary vessels which covers 80% of the cardiac surfaces and accounts for 20% of the total heart weight. Recently it has been recognized as a new risk factor for atherosclerotic CVD in non-uremic patients (6-9). EFT has the same origin as abdominal visceral fat tissue and secretes proatherosclerotic and proinflamatory cytokines, such as TNF-α, IL-6 and several adipocytokines, which might play a role in atherosclerotic CVD (10-13). Interestingly, the relationship between atherosclerosis and EFT is independent of diabetic status and body mass index (14). Even though the association between EFT and atherosclerosis in the non-uremic population has been shown in a recent meta-analysis (15), the role of EFT in HD patients still remains unknown. In a recent study, Turan et al reported that EFT was associated with carotid intima thickness, arterial stiffness and coronary artery calcification; however this association lost its significance after adjusting for other atherosclerotic risk factors (16). On the other hand, Turkmen et al. showed an association between EFT volume and coronary artery calcification in peritoneal dialysis patients (17).Recent studies evaluated the association between EFT and atherosclerosis in dialysis patients by measuring carotid intima thickness, arterial stiffness and coronary artery calcification (16,17).

The aim of this study was to investigate the EFT thickness in hemodialysis patients.

MATERIAL-METHOD

Seventy-one non-diabetic HD patients (25 male, 46 female) and 65 (23 male, 42 female) age and sex-matched healthy controls were included in the study. All HD patients had creatinine clearances of less than 10 ml/min/1.73 m^2 and had been on chronic HD programme thrice weekly with 4-hour sessions with bicarbonate containing dialysate for at least one year. The blood flow rate was kept between 300-350 ml/min whereas the dialysate flow rate was kept at 500 ml/min. Kt/V was equal to or more than 1.4. All of the patients were maintained at their target dry body weight. Healthy individuals without any chronic disease were included as the control group. None of the healthy individuals were taking antibiotics, corticosteroids, cytotoxic drugs, vitamin supplementations or any kind of medications. Both the patient and control groups were non-smokers and did not consume alcohol. Exclusion criteria were defined as preexisting valvular heart disease, myocardial infarction, any prior coronary intervention, dilated or hypertrophic cardiomyopathy, congestive heart failure and cardiac arrhythmia. Individuals in whom the left anterior descending artery was not visualized adequately by Doppler echocardiography were also excluded. Eighteen patients were on treatment with antihypertensive drugs with 7, 3 and 8 patients receiving

angiotensin converting enzyme (ACE) inhibitor, angiotensin receptor blocker (ARB) and beta blocker therapy, respectively. Thirty-two patients were on calcium-containing phosphate binder therapy and 28 patients were taking vitamin D. None of the patients received statine therapy. All study patients and healthy controls gave written informed consent. The study has been approved by the local ethics committee and has therefore been performed in accordance with the ethical standards of the Helsinki decleration.

SAMPLE COLLECTION AND ANALYSİS

Fasting serum samples were obtained in the early morning for biochemical studies. All biochemical blood samples were measured prior to the midweek HD session. Blood samples were drawn from all patients (before HD session) and controls into vacutainer tubes containing lithium heparin as anticoagulant. After centrifugation (+4°C,5000 rpm,10 min.), the plasma was harvested and stored at -80°C until biochemical analyses.

EFT MEASUREMENT

Each patient underwent transthoracic echocardiograpy performed with a VIVID 7 (GE,USA) instrument according to standard techniques in the left lateral decubitus position. Echocardiographic images were recorded onto a computerized database and videotape. EFT was measured on the free wall of right ventricle from the parasternal long-axis view. EFT was defined as an echo-free space between pericardial layers on the 2-dimensional echocardiography. EFT was measured perpendicularly on the free wall of right ventricle at end-diastole for 3 cardiac cycles. In order to standardize the measuring point between different observers, we used the aortic annulus as an anatomical reference. The measurement was performed at a point on the free wall of the right ventricle along the midline of the ultrasound beam perpendicular to the aortic annulus. The average value measured from 3 cardiac cycles for each echocardiographic view was used for the statistical analysis.

STATISTICS

Descriptive statistics for continuous variables were expressed as mean ± standard deviation (SD). Two independent samples t-test was used to compare means of control and patient groups for EFT and CFR levels. Pearson's correlation test was performed to explore the linear relationships between EFT and CFR levels. A multiple regression analysis was used to determine the independent predictors of EFT. Age, BMI, mean arterial pressure, total cholesterol ,triglyceride, LDL cholesterol levels and CFR were incorporated in to the model as independent variables. A p-value <0.05 was interpreted as statistically significant. All statistical analysis was performed with statistical analysis programme (SPSS 13.0 for Windows).

RESULTS

Patient characteristics and clinical findings.

The baseline characteristics of the 71 patients (mean age 45 ± 14 years) and 65 controls (mean age 44± 8 years) are presented in Table-1. There were no differences regarding age, gender, body mass index (BMI) and systolic/diastolic blood pressure levels between the two groups. Serum cholesterol, triglyceride and glucose levels were also similar in both groups. Serum parathyroid hormone levels were significantly higher in the patient group as expected (305 ± 64.20 vs. 40.88 ± 24.20 pg/ml, $p<0.05$) (**Table-1**).

	Hemodialysis group (n=71)	Control group (n=65)	p value
Age (years)	45 ± 14	44 ± 8	0.121
Sex (male/female)	25/46	23/42	0.094
BMI (kg/m2)	24.16 ± 6.48	25.24 ± 6.01	0.106
Dialysis (months)	54 ± 26	0	
SBP (mmHg)	121.45 ± 27.02	120.68 ± 18.50	0.118
DBP (mmHg)	72.15 ± 12.56	68.00 ± 10.04	0.087
MAP (mmHg)	88.58 ± 17.38	85.56 ± 12.86	0.091
Glucose (mg/dL)	92.50 ± 12.35	86.30 ± 13.45	0.085
Total Chol.(mg/dL)	191.35 ± 28.60	184.10 ± 27.48	0.071
LDL Chol.(mg/dL)	114.72 ± 28.44	108.65 ± 26.12	0.093
HDL Chol. (mg/dL)	32.44 ± 11.78	44.55 ± 17.64	0.069
Triglycerides (mg/dL)	152.40 ± 65.22	161.58 ± 48.60	0.062
PTH (pg/mL)	305.40 ± 64.20*	40.88 ± 24.20	0.003
CRP(mgr/L)	1.6 ± 1.5	1.5 ± 1.3	0.082

Table 1. *Clinical and demographic characteristics of study groups.*

*Data is presented as mean ± SD. BMI: body mass index, SBP: systolic blood pressure, DBP: diastolic blood pressure, MAP: mean arterial pressure, LDL: low density lipoprotein, HDL: high density lipoprotein, PTH: parathormone, Chol: Cholesterol, CRP: C- reactive protein , *p<0,05 vs. control*

EFT values

EFT was significantly higher in HD patients as compared to healthy controls (6.53 ± 1.01 vs. 5.79 ± 1.06 mm respectively, p<0.001) (Table-2). In the univariate correlation analysis, EFT was positively correlated with age, BMI and total cholesterol levels (**Table 2**).

Parameters	r	p value
Age (years)	0.287	0.001
Total cholesterol (mgr/dl)	0.345	<0.001
BMI	0.380	<0.001

Table 2. *Univariate correlation analysis of parameters of HD patients related to EFT thickness*

Multiple linear regression analysis was used to define independent determinants of EFT in HD patients. Age, BMI, mean arterial pressure, total cholesterol, triglyceride, LDL cholesterol were all incorporated into the model. According to linear regression analysis, age, BMI, total cholesterol levels and were found to be independent predictors of EFT .

DISCUSSION

This study was designed to assess EFT thickness among HD patients. The main findings of this study were as follows; i) EFT measured by TTDE was significantly higher in HD patients, ii) EFT thickness was positively correlated with age, BMI and total cholesterol levels.

The great burden of CVD and its high mortality rates force investigators to find modifiable new risk factors and define the underlying pathophysiologic mechanisms of atherosclerosis in HD patients. Recently, EFT has been defined as a risk factor for CVD in the non-uremic population (9,15). EFT originates from the splancnopleuric mesoderm like the abdominal visceral fat deposits and is metabolically an active organ producing several cytokines, including TNF-α, IL-6, omentin, leptin, angiotensinogen and PAI-1, which are mostly proinflammatory and proatherogenic (12,14,23-25). In health, EFT plays a buffering role by scavenging free fatty acids (FFA) that are toxic to the myocardium while under ischemic conditions such as atherosclerosis, it delivers toxic FFA as an energy source to the myocardium (26). The role of EFT in CVD among uremic patients has recently

been investigated in several studies. In a study by Turkmen et al., the authors found a significant relationship between EFT volume and the presence of the malnutrition-inflammation-atherosclerosis calcification syndrome in HD patients (27). In another study by the same group, they reported a relationship between EFT and coronary artery calcification among peritoneal dialysis patients (17). In a recently published study by Turan et al, EFT volume was correlated with cardiovascular surrogate markers such as carotid intima-media thickness and pulse-wave velocity. However this did not reach statistical significance after adjusting for traditional risk factors such as BMI, age, cholesterol levels and systolic blood pressure (16). In our study, we also found higher EFT values measured by TTDE in HD patients when compared to healthy controls. Although many authors advise measuring EFT using multislice computerised tomography (MSCT) or magnetic resonance imaging (MRI), TTDE is a simple and inexpensive method for EFT measurement. In 2003, Iacobellis et al reported the echocardiographic measurement of EFT for the first time. They showed that EFT measurements with echocardiography were correlated with EFT measurements by MRI as well as anthropometric and metabolic parameters (24).

The present study evaluated EFT thickness in HD patients. EFT thickness was increased in HD patient population compared to healthy controls. In accordance with previous studies, we also found correlations between EFT and age, total cholesterol and BMI. Therefore based on these results, it can be postulated that atherosclerosis in the coronary vascular system starts in the early stages of uremia even when no clinical signs are present. Increased EFT is probably both a marker of atherosclerosis and a driving force for endothelial damage by producing proatherogenic cytokines in this patient population. Thus, EFT measurements can be used for assessing the atherosclerotic load of these patients at the very beginning of the uremic state and may be used for detecting high risk patients for further interventions in order to decrease the high mortality rates seen in this patient group.

In the present study 8 patients in the dialysis group were on beta blocker treatment because of stable coronary artery disease in their patient history. Demographic characteristics and baseline laboratory parameters of this subgroup were not significantly different from the HD group. We also reported that 10 of 71 HD patients have ACE inhibitor/ARB treatment in their hypertensive medication. There is no data about the effect of ACE inhibition on EFT in HD patients in the literature. According to the results of the subgroup analysis, ACE inhibition did not affect EFT in HD patients. However, the present subgroup analysis is insufficient to interpret the effects of ACE inhibitor/ARB treatment due to the low number of patients.

This study has several limitations. First, since EFT has a three dimensional distribution, two dimensional echocardiographic measurements may not be enough to assess the total amount of EFT. Further studies are needed to compare MSCT, MRI and echocardiographic EFT measurements. Secondly,the design of the study is unable to define the importance of increased EFT in terms of mortality. Thus, prospective long-term studies are needed. Finally, these results should be interpreted with caution because of the small number of patients and further studies are needed to shed more light on this issue.

In conclusion, this study showed that EFT was increased and inversely correlated with CFR in HD patients. Further studies are needed to evaluate the role of EFT in CVD and find treatment strategies to decrease EFT volume.

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