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THE INVESTIGATION OF ATHEROSCLEROTIC HEART DISEASE BY THALLIUM-201 STRESS-REINJECTION SPECT, ECHOCARDIOGRAPHY AND SERUM LIPID PROFILES IN CAPD PATIENTS

SAPD'Li HASTALARDA Tl-201 STRES-REİNJEKSİON SPECT, EKOKARDİOGRAFİ VE SERUM LİPİT PROFİLİ İLE ATEROSKLEROTİK KALP HASTALIĞININ ARAŞTIRILMASI

İsmet Sarıkaya, Itır Yegenaga*

Depts of Nuclear Medicine and Nephrology*, Kocaeli University School of Medicine, Derince, Kocaeli

OZET

Çalışmamızın amacı sürekli ayaktan periton diyalizi (SAPD) uygulanan hastalarda koroner arter hastalığım araştırmaktı. Serum lipit profili saptanan 15 hastaya stress-reinjeksion Tl-201 nyokard perfüzyon sintigrafisi ve ekokardiografı yapıldı. On hastada serum lipit profilinde bozukluk, sekiz hastada Ekokardiografide sol ventrikül hipertrofisi(L VH) ve diastolik disfonksiyonu (DD) saptandı.Anjinal ağrılı beş hastanın üçünde (anterolateral iskemi.anteroapikal iskemi,anterior-inferior sabit defect),ağrısız bir hastada (apical iskemi) myokard perfüzyon sintigrafisinde bozukluk görüldü. Bu dört hastanın ikisinde lipit profili anormaldi ve Ekokardigrafi ile LVH ve DD tespit edildi. SAPD altındaki hastalarda koroner arter hastalığının insidensi yüksek ve etyolojisi de multifaktöryel olduğundan, erken dönemde hastalığın tanısı morbidite ve mortaliteyi azaltmak açısından oldukça önemlidir.

Anahtar Kelimeler: Thallium-201, SPECT, SAPD

SUMMARY

The aim of our study was to investigate coronary artery disease(CAD) in patients receiving continuous ambulatory peritoneal dialysis (CAPD) treatment. We performed thallium-201 stress-reinjection myocard perfusion SPECT, echocardiography (ECHO) and determined serum lipid profiles in 15 patients receiving CAPD treatment. Serum lipid profile abnormalities were detected in 10 patients. 'Left ventricular hypertrophy (LVH) and diastolic dysfunction (DD) were detected in 8 patients echocardiographically. Myocard perfusion abnormalities were observed in 3 of 5 patients with angina pectoris and one patient without angina pectoris. Anterolateral ischemia, anteroapical ischemia and anterior-inferior fixed perfusion defects were detected in 3 patients with angina pectoris and apical ischemia in a patient without anginal symptom. 2 of these 4 patients had lipid profile abnormalities ***and*** *echocardiographically LVH, DD and wall* ***motion*** *abnormalities were detected in these patients.*

Because the incidence of CAD is high and the etiology is multifactoriel in patients receiving CAPD, to diagnose of CAD in early period is extremely important to decrease cardiovasculary morbidity and mortality.

Key Words: Thallium-201, SPECT, CAPD

INTRODUCTION

Atherosclerotic heart disease is the leading cause of death in patients with end stage renal disease(ESRD) on continuous ambulatory peritoneal dialysis (CAPD) treatment. Left ventricular hypertrophy (LVH) and abnormalities of lipoprotein metabolism are both possible factors for the high risk of cardiovascular death in patients with ESRD on CAPD (1-4). In addition to the typical dyslipidemia found in CAPD patients, high levels of Lp(a) and fibrinogen may contribute to the elevated risk of coronary artery disease (CAD) and other cardiovascular complications (5,6). Positron Emission Tomography (PET) and Single Photon Emission Computerized Tomography (SPECT) are sensitive and noninvasive methods for the detection of CAD. Altough PET is superior to the SPECT , the expense of PET has precluded its widespread use. Thallium-201 Myocardial perfusion SPECT has been used extensively for the determination of the presence and extent of CAD.

In this study, we performed thallium-201 stress-reinjection SPECT , echocardiography (ECHO) and serum lipid profiles in patients on CAPD treatment for the detection of CAD. Altough we planned to follow up patients every six month with SPECT and seum lipid profiles, we couldnt complete our project due to financial factors. We are presenting our 15 patients' SPECT, serum lipid profiles and ECHO results.

MATERIALS AND METHODS

15 patients (8 women, 7 men) with ESRD and receiving CAPD treatment were included in the study. The ages of the patients were ranging from 25 to 65 years (Mean age 49±3 years) and duration of CAPD treatment was ranging from 6 months to 24 months (Mean duration 12 1 months) . Serum lipid profiles (total cholesterol, total tryglycerides , low-density lipoprotein(LDL), high-densiy lipoprotein (HDL) and very-low-density lipoprotein (VLDL)) were determined in all patients. Total cholesterol, triglycerides, and after precipitation of the apo B containing lipoproteins, HDL were measured enzymatically with Technicon Opera Autoanalyzer using Biotriol kits. LDL was calculated according to Friedewald formula, VLDL was calculated dividing the triglycerides levels by five. All patients were studied by thallium-201 stress-reinjection myocard perfusion SPECT and ECHO. Thallium-201 stress-reinjection SPECT study was performed after a 12-hr overnight fast and in the absence of antianginal medication. For stress study , some patients were given 375 mg oral dipyridamole, some patients underwent exercise treadmill testing using modified Bruce protocol achieving > 85% of age-predicted maximal heart rate. One hour after the oral dipyridamole administration and at peak exercise on treadmill 2 mCi Tl-201 was injected intravenously and continued to exercise for 1 additional minute for exercise study. Five minutes after the injection, SPECT imaging was started. Three hours later, second SPECT study was repeated after re-injection of 1 mCi Tl-201, because re-injection is more sensitive than redistribution to differ scar tissue from viable tissue. For all SPECT studies, the patients were positioned supine and data were collected over a 180-degree rotational arc (thirty-two projections , 40 seconds/ projection) using a single-head gamma camera equipped with a low energy, medium-resolution, high sensitivity, parallel - hole collimator centered on the 68 -keV photo peak with a 20 % window. All images were stored on a 64x64 matrix. Stress and re-injection Tl-201 SPECT images were reconstructed into short-axis, horizontal long-axis, and vertical long-axis views. Images were analysed visually by two Nuclear Medicine specialists.

Two-dimensional echocardiographic analysis of regional wall motion and thickening, sistolic and diastolic function were performed. Ejection Fraction (EF)% was calculated using modified Simpson method.

RESULTS

Clinical and laboratory findings of patients were shown in Table 1. Seven patients were diabetic, 4 patients had HT, five had angina pectoris attacks. Mean duration of ESRD was 415 months. Serum lipid profile abnormalities were detected in 10 patients. Increased serum cholesterol level was detected in 7 patients, triglyserides in 8, VLDL in 8 and LDL in 4 patients and low HDL level in 6 patients. MeanSD values of total cholesterol triglycerides, HDL, VLDL and LDL were 19112, 19923, 382, 415,1119 mg/dl, respectively. Serum lipid values of patients are shown in Table 2. LVH and DD were detected in 8 patients echocardiographically. Myocard perfusion abnormalities were observed in 3 of 5 patients with angina pectoris and one patient without angina pectoris. In addition, decreased perfusion were observed in inferior wall both stress and reinjection SPECT studies in 4 patients. These patients' 180-degree planar images were evaluated carefully and inferior wall attenuation was considered due to peritoneal fluid.

Patients Findings:

Case 5: U.Y., 62 years old woman. She has diabetes mellitus (DM) for 10 years and nephropathy developed 2 years ago. She has hypertension (HT) for 5 years and under the CAPD treatment for 19 months. She had also angina pectoris attacks. Increased total serum cholesterol and LDL levels and mild degree of anemia were detected. Even tough ECG did not show any abnormality, DD and LVH and basal hypocinesia were detected by ECHO. Ejection fraction (EF) was 56 %. Anterolateral wall ischemia in a small region was detected in SPECT study (Figure 1).

Case 6: A.E., 47 years old woman. She has nondiabetic nephropathy for 2 years and was hypertensive for 2 years. She has been receiving CAPD treatment for 1 year. Increased level of total tryglicerides and VLDL was determined in serum. She was anemic. ECG was found normal. Echocardiographically, LVH was detected and EF% was 64%. Apical ischemia was detected by SPECT.

Case 11: M.O., 57 years old man. He has DM for 15 years. He has been receiving CAPD for 2 years. He has angina pectoris complaint. ECG showed QS formation in the derivations of VI-4. Apical and anterior hypocinesia and inferior, inferoseptal acinesia, DD and LVH were detected by ECHO with 50% EF. Serum lipid profile was normal. He was anemic. Apical, anterior and inferior large fixed perfusion defects (scar) were detected by SPECT (Figure 2). In addition there was left ventricular cavitany dilatation.

Case 12: S.O., 60 years old man. He has nondiabetic CRF for 11 years and on CAPD for 1 year. He had unstable angina pectoris. He was hypertensive for 2 years. ECG finding was T wave inversion in the derivation of aVL. DD and LVH was detected by ECHO. EF was 65%. Serum lipid profile was normal. Anteroapical ischemia was detected by SPECT.

Table 1: Clinical and laboratorical findings of the patients

No Id.	sex -	Age <yr)	CRF dur. (mo)	CAPD dur. (mo)	HT	DM	Anemia (htc35%)	Lipid Dist.	angin a	ECG	ECHO (EF%)	SPECT
1AT	M	65	48	12	-	-	+	+		N	LVD,DD,68%	N
2IK	M	40	24	12	-	-	+	+	-	N	LVD,DD,59%	N
3CT	F	35	120	24	-	-	+	+	+	P	N	N
4SAK	M	55	24	15	-	-	+	+	-	N	N	N
5UY	F	62	24	19	+	+	+	+	+	N	LVD,DD,BH5I%	Al is
6AE	F	47	18	12	+	-	+	+	-	N	LVH,64%	Apis
7NB	F	25	12	12	-	-	+	N	-	N	N	N
8HA	M	46	72	7	-	+	+	+	-	P	N	N
9AZ	M	36	18	6	-	+	+	N	+	P	N	N
lOAF	M	56	24	6	+	+		+	-	N	N	N
HMO	M	57	24	24		+	+	N	+	P	LVH,DD,50%A-Ap H,I,IS Ac	A.IAfdp
12SO	M	60	132	12	+		+	N	+	P	LVD,DD,65%	N
13EK	F	53	12	6	-	+	+	+	-	P	LVH,DD,64%	N
14MC	F	40	48	10	-	+	-	N		N	N	N
15UO	F	65	24	6			+	+	–	P	DD.SD.45%	N

CRF: Chronic Renal Failure, CAPD : continuous ambulatory peritoneal dialysis, HT: Hypertension, DM: Diabetes Mellitus.
LVH: left ventricular hypertrophy, DD: Diastolic dysfunction, SD: Systolic dysfunction, Ac: Acinesia, H:Hypocinesia, A: Anterior, L:Lateral, I: Inferior, Ap: Apical, S: Septal, B: Basal, is: ischemia, fd: fixed perfusion defect, P: Pathologic, N: Normal.

Table 2: Serum lipoprotein values and medication of the patients

No	Tot. chol. (140-200 mg/dl)	Tot. Tryg (60-170 mg/dl).	HDL (<35mg/dl)	VLDL (0-30 mg/dl)	LDL (0-130 mg/dl)	Lipid lowering theraphy
1	245	300	47	60	140	+
2	274	391	30	78	160	+
3	204	240	34	48	117	-
4	255	208	44	42	169	-
5	222	127	50	25	147	-
6	171	236	32	47	92	-
7	187	113	37	23	127	-
8	210	170	50	30	122	-
9	131	85	23	17	91	-
10	208	229	38	46	124	-
11	165	115	32	25	120	- '
12	111	96	50	19	42	-
13	193	301	38	60	95	+
14	129	115	34	23	72	-
15	168	270	36	78	54	-
Mean±SD	191±12	199±23	382	415	111±9	

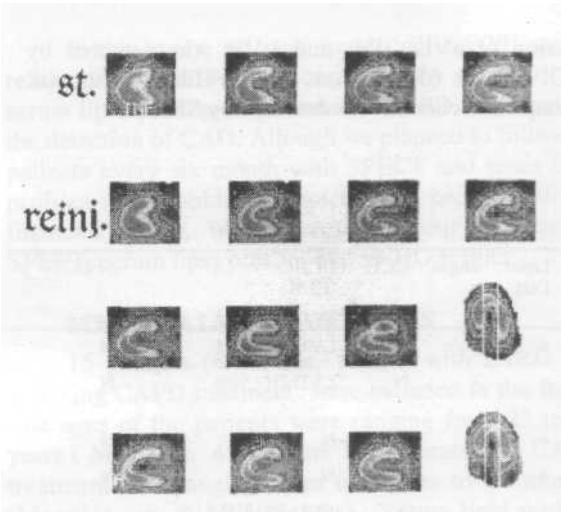

Figure 1: Anterolateral focal perfusion defect in stress vertical-long axis images. Improvement in perfusion (ischemia) in this area in reinjection images.

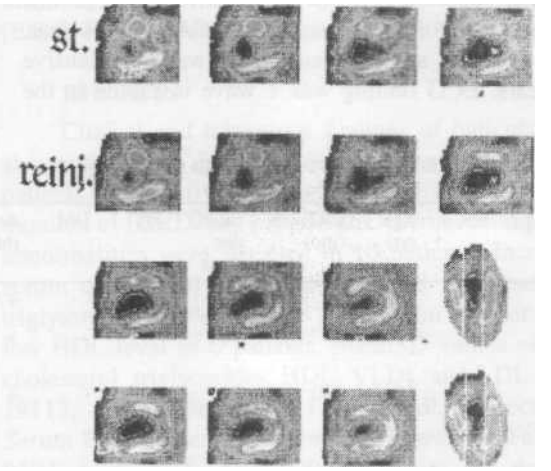

Figure 2: Anterior, apical and inferior fixed perfusion defects (scar) in stress and reinjection images in vertical long-axis slices.

DISCUSSION

Increased incidence of cardiovascular morbidity and mortality has been observed in CAPD patients. Patients with ESRD or undergoing dialysis treatment are particularly prone to develop accelerated atherosclerosis., Hyperlipidemia is an important risk factor in the pathogenesis of coronary artery disease (1-4). Several studies have demonstrated that CAPD induces hyperlipidemia which becomes apparent within the first few months of therapy. Dyslipidemia, especially high LDL, and low HDL levels carries great risk for CAD. CAPD patients have these kinds of abnormalities and must be treated as soon as diagnosed. LVH is frequent in this patient population, and is associated with specific clinical patterns and an increased risk of death. HT and anemia are the etiological factors for the development of LVH and cardiac dysfunction (1,7-8). CAPD patients might be at greater risk of developing coronary artery disease than HD patients who are also at increased risk as compared with normals (3). Because the incidence of atherosclerotic CAD is high and the etiology of CAD is multifactoriel in patients receiving CAPD treatment, early diagnosing and planning proper treatment regimen are extremely important in these patient population. ECG are not specific for the detection of CAD in dialysis population. The sensitivty of efor test is low, because of low efor tolerance of CAPD patients. Left ventricular wall dysfunction detected by equilibrium radionuclide angiocardiography (MUGA) and ECHO may support CAD. Altough coronary angiography is sensitive method, it is invasive and has some complications in these population.

Because high incidence of CAD, more sensitive and noninvasive methods will be extremely helpful in this population. Radiotracer studies play a major role in the diagnosis of CAD. Radiotracer methods are both sensitive and noninvasive for the detection of presence and extent of CAD. PET has been used for quantification of regional myocardial blood flow, based on the use of rubidium-82, nitrogen-13 ammonia, oxygen-15-labeled water and copper-64-labeled PTSU. Altough PET is superior to the SPECT for both clinical and research applications , the expense of PET has precluded its widespread use. In routine, Myocardial perfusion SPECT has been used extensively for the determination of the presence and extent of CAD. There are several SPECT radiopharmaceuticals for the evaluation of myocard perfusion. The most commonly used SPECT radionuclide for the detection of CAD is thallium-201. The most widely used procedure thallium-201 SPECT after exercise or pharmacolgical stress. Thallium-201 enters the cardiac myocyte by active transport using the sodium-potassium ATPase-dependent exchange mechanism. Distribution within the myocardium is proportional to myocardial blood flow (9). The sensitivity of thallium-201 SPECT for the detection of CAD was found %92 (10) .

In our study, we detected myocardial perfusion abnormalities in four patients by thallium-201 SPECT. Two patients had serum lipid profile abnormalities and one of them had also DM and HT, the other patient had HT. No serum lipid profile abnormalities were detected

in the other two patients. One of these two patients had DM , the other had HT. The four patients with perfusion defects were on CAPD treatment over one year. Although the duration of CAPD treatment seems to be correlate with positive SPECT findings, in according to our results we cannot define that the cause of myocardial perfusion abnormality is due CAPD treatment, because we had no myocard SPECT studies of these patients before CAPD treatment. Also our 7 patients had DM and one patient had HT before ESRD and CAPD treatment. Both of them are major risk factors for development of CAD. There was HT also in our other three patients, but it started with ESRD and CAPD treatment. Besides serum lipid profile abnormalities, hypertension is also a major risk for cardiovascular complications in dialysis patients. Approximately 50%-60% of CAPD patients have hypertension (11). Diabetes mellitus is one of the most prevalent causes of renal disease, and approximately 30% of all insulin-dependent diabetic patients die of renal failure(12).

. In our study, we also observed inferior myocardial wall defects in four of the 15 patients on SPECT images. We considered peritoneal fluid as the probable cause of inferior wall perfusion defects. Patients on peritoneal dialysis have as much as 2000 cc of peritoneal fluid, which can elevate the patient's diaphragm. We evaluate carefully of the 180-degree planar images and considered these findings was due to inferior wall attenuation problem rather than myocardial disease in that region, although scar could not be entirely excluded as a cause of the inferior defect. Inferior perfusion defects was reported in patients on CAPD treatment due to inferior attenuation caused by peritoneal fluid in a study (13).

Dialysis patients have many cardiovascular risk factors and cardiovascular morbidity and mortality is high. Myocardial perfusion SPECT is known a reliable, noninvasive and sensitive method to diagnose CAD. We think that to follow up the patients with SPECT and other diagnostic tests to detect CAD will be an extremely important approach to start proper treatment regimen in early period to decrease cardiovascular morbidity and mortality.

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