RIGHT HEART CATHETERIZATION AND ENDOMYOCARDIAL BIOPSY IN THE PATIENTS WITH SICKLE CELL ANEMIA

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SUMMARY: The aim of the study was to investigate the pathological changes of cardiac morphology and cardiac muscle in sickle cell anemia. Eight male and two female patients (aged 16-29 years) were included in this study. The patients were diagnosed with total blood count and hemoglobin electrophoresis. In all patients cardiac chambers dilatation systolic and/or diastolic function disturbances were shown with cardiac findings, electrocardiography, telecardiography and echocardiography. All the patients subsequently underwent right heart catheterization and endomyocardial biopsy. It was found that pulmonary arterial and right ventricular pressures were high in 8 patients (80%). Ultra-structure of the myocardium was nonspecific. By light microscopy myocardial hypertrophy was observed in 9 cases (90%), myocardial fibrosis in 7 (70%) and interstitial edema in 4 (30%) It was concluded that in these patients the above cardiac findings were sub-clinical, non specific and of medium intensity.

Key Words: Sickle cell anemia, cor pulmonale, endomyocardial biopsy.

INTRODUCTION

Sickle cell anemia (SCA) is one of the hemoglobinopathies which threatens the life. It also exists in Türkiye especially in the Çukurova region (East Mediterranean shores) with about a 3.4% prevalence (1). Mean life in these patients is about 40 years. One of the causes of high mortality in these cases is secondary heart disease complications: the left ventricular hypertrophy, cor pulmonale and heart failure (2,3).

The aim of our study was to investigate the cardiac abnormalities encountered in SCA cases with invasive methods specifically right heart catheterization and endomyocardial biopsy.

MATERIALS AND METHODS

The patients, who were included to this study, were diagnosed by hemoglobin electrophoresis. Detailed clinical evaluation and routine laboratory tests were performed. The procedure was explained and permission for procedure were

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Table 1: The features of the patients who underwent EMB.

	Age	Hb.E	HTC	MCV	Ferritin	ECG	Tele
Male (8)	22 ± 7	SS	26 ± 3	97 ± 7	477 ± 365	LVH	CMG
Female (2)	27 ± 0	SS	28 ± 0	96 ± 0	478 ± 369	LVH	CMG

Hb. E: Hemoglobin electrophoresis HTC: Hemotocrit, MCV: Mean corpuscular volum, ECG: Electrocardiogram. Tele: Telecardiogram. LVH: Left ventricular hypertophy. CMG: Cardiomegaly.

taken from the patients who had no cardiac symptoms but had cardiomegaly and echocardiographic diastolic dysfunction. Right heart catheterization and endomyocardial biopsy (EMB) were done by femoral approach. It was entered through right femoral vein percutanously with Seldinger method, then sheath was put into the vein. Multipurpose catheter was advanced through right femoral, iliac, inferior vena cava until right atrium. It was advanced through tricuspid valve to right ventricle and through the pulmonary valve into the main pulmonary artery and advanced until vedged. It was thus possible to measure subsequently, the right atrial (RA), the pulmonary arterial and the pulmonary capillary vedge pressures. After procedures long transseptal sheath (Müllen sheath) is inserted form femoral vein to right atrium and placed in such a way to look toward to right ventricle. Using this sheat it was entered to right ventricle with 7F and biyoptom 2-3 pieces were taken from apex and were submitted to histologic examination.

The statistical analysis of the results were made using student-t (paired) test.

Table 2: The heart pressures of the patients who underwent E.

	Pressures (mm Hg)	Ranges
Pulmonery capillary	18.4 ± 7	5-30
Pulmonery arter systolic	38.1 ± 13.7	22-57
Pulmonery arter diastolic	13.5 ± 7.8	4-25
Pulmonery arter average	28.9 ± 11.4	12-42
Right ventricle systolic	50.6 ± 16.7	22-70
Right ventricle diastolic	5.8 ± 3	0-12
Right atrium	2.8 ± 1	2-5

We were found that mean PA pressures were higher than 40 mmHg in 4 patients, higher than 30 mm Hg in 2 patients and higher than 20 mmHg in 2 patients.

RESULTS

Eight male (mean age 22.7) and two female patients aged 16 to 29 years were included to this study. They were all homozygous for HbS. The clinical features of the patients are summarized in Table 1 . Cardiac catheter findings are shown in Table 2 and 3. All pathological preparations for the light microscopic evaluations of EMB were stained with iron and amyloid and all results were reported as negative. It was found that myocardial fibrillary hypertrophy existed in 90%, fibrosis in 70% and interstitial edema in 40% of patients. No complication developed in patients who underwent EMB.

DISCUSSION

In many investigations it was observed that cardiac findings in SCA patients were correlated with the severity of anemia and its duration (4-6). It is proposed that these symptoms disturb cardiac diastolic function (insufficient cardiac response to exercise). But it is also proposed that dyspnea may be due to cor pulmonale and lung infarction which are also common findings in SCA (7-10). In some investigations on SCA, invasive methods were used among which the most important are cardiac catheterization and EMB. The latter has been used for diagnosis of myocarditis and infiltrative myocardial diseases. Durant *et. al.* (7), reported that SCA patients had increased pulmonary pressure. On the other hand, Shubin *et. al.* (11), reported that SCA patients had normal pulmonary arterial pressure. Fenoglio *et. al.* (12), emphasized that EMB was necessary for follow up and treatment of myocarditis. Mason *et. al.* (13), emphasized that EMB was necessary for

Table 3: Myocardial morphologies of EMB.

	Hypertrophy	Fibrosis	Interstitiel edema
Male	7	6	3
Femal	2	1	1
Total	9(90%)	7(70%)	4(40%)

immunosuppressive treatment. Rubler *et. al.* (14), reported that SCA patients had increased cardiac mass and cellular infiltration. Gery *et. al.* (15), observed biventricular hypertrophy and dilatation in their autopsy series. Stark *et. al.*, reported on SCA patient with increased pulmonary arterial pressure, normal capillary pressure and decreased cardiac output (16). Armoly *et. al.* (11), reported that right atrium, right ventricle and pulmonary arterial pressures were within normal range in 7 SCA patients. Birand *et. al.* (17), investigated cardiac findings in 28 SCA patients and they found that 2 patients had myocardial hypertrophy, 1 patient had hemosiderosis, 1 patient had edema, congestion, mononuclear cell infiltration and 4 patients had interstitial edema, and rare mononuclear cell infiltration in their EMB. Fenoglio *et. al.* (16), took EMB from 34 heart failure patients with unknown etiology and they found that most frequent findings in EMB of myocarditis were also cell damage and interstitial fibrosis. Rubler *et. al.* (14), investigated autopsy of 4 SCA patients and found that all patients had left and right ventricular hypertrophy, pulmonary arterial widening, pulmonary arterial thrombus and increase in cardiac mass. They believe that these findings are the result of volume overload due to anemia. In our investigation of right heart catheterization findings 4 patients had mean PA pressure higher than 40 mmHg, 2 patients higher than 20 mmHg and only 2 patients had mean PA pressure lower than 20 mmHg.

The results of our investigation are similar to those reported by Durant, Rubler *et. al.* All pathological preparations of EMB were stained for iron and amyloid, but the results were reported negative. It was observed that myocardial fibrillary hypertrophy was present in 90%, interstitial fibrosis in 70% and interstitial edema in 40% of patients. As a result we can say that myocardial hypertrophy and interstitial fibrosis are most frequent findings of the myocardium in EMB of SCA patients. Thus our results are similar to the autopsy findings of other investigations. Blood trans-fusions are generally necessary in SCA. Occurrence of Hepatitis B carditis and hemachromatosis should therefore be searched for in SCA. But in our preliminary studies we did not encounter these abnormalities.

In conclusion, SCA characterized by wide spectrum of clinical variations is an important health problem in Türkiye especially in Çukurova region. Because of severe complications of this ailment and its high mortality rate, invasive methods should be employed even though the patients may have no cardiac symptoms. The patients should be adequately investigated for cardiac involment in SCA patients with immunological and ultra-structural studies.

REFERENCES

1. Koçak R, Alparslan N, Agridag G, Baslamisli F, Aksungur P and Koltas S : The frequency of anemia, iron deficiency, hemoglobin S and beta thalassemia in the south of Türkiye. Eur J Epidemiol (in press).

2. Abdullah CA, Siddiqui A and Taujiddin M : Systolic time intervals in chronic anemia. Am Heart J, 94: 287-91, 1977.3. Collins FS and Eugene PO : Pulmonary hypertension and cor pulmonale in the sickle hemoglobinopathies. Am J Med, 73: 814-21, 1982.

4. Falk RH and William BH : The heart in sickle cell anemia. Arch Intern Med, 142:1680-84, 1982.

5. Alpert BS, Victoria D, William BS, et al : Longitudinal exercise hemodynamics in children with sickle cell anemia. AJDC, p 138, 1984.

6. Appleton CP, Hatle LK and Popp RL : Relation of transmit-

tal flow velocity patterns to left ventricular diastolic function: New insights from a combined hemodynamic and Doppler echocardiographic study. JACC, 12:2:426-440, 1988.

7. Durant JR and Cortes FM : Occlusive pulmonary vascular disease associated with hemoglobin SC disease. Am Heart J, 71:1:100-106, 1966.

8. Mardelle T, Ekra A and Bertrand A : LV function in sickle cell anemia. Am Heart J, 112:1356-7, 1986.

9. Collins FS and Eugene PO : Pulmonary hypertension and cor pulmonale in the sickle hemoglobinopathies. Am J Med, 73:814-21, 1982.

10. Lindsay J and Patterson RH : The cardiovascular manifestations of sickle cell disease. Arch Intern Med, 133:643-51, 1974.

11. Armoly MF : Ocular manifestations sickle cell disease. Arch Intern Med, 133: 670-679, 1974.

12. Fenoglio JJ, Ursell PC and Kellogo CF : Diagnosis and classification of myocarditis by endomyocardial biopsy. N Eng JM, 308:1:12-8, 1983.

13. Mason JW, Billingham ME and Ricci DR : Treatment of acute myocarditis inflammatory assisted by endomyocardial biopsy. Am J Cardiol, 45:1037-1044, 1980.

14. Rubler S and Altman R : Sickle cell states and cardiomyopathy. Am J Cardiol, 19: 867-73, 1967.

15. Gerry JL, Bernadine HB and Facc GMH : Clinicopathologic analysis of cardiac dysfunction in 52 patients with sickle cell anemia. Am J Cardiol, 42: 211-216, 1978.

16. Stark P and Pfeiffer WR : Intrathoracic manifestations of sickle cell disease. Radiology, 25: 33-35, 1985.

17. Birand A, Demirtas M, Tuncer I, et al : The heart in sickle cell anemia. 1. (Preliminary report). II Cuore, 7:(suppl)3, 1990.

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