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ORIGINAL ARTICLE

ECHOCARDIOGRAPHY IN SEVERE ANEMIA

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ABSTRACT

Anemia is probably the most common condition which may increase the cardiac output at rest.[1]Chronic anemia in man has various effects dominated by cardiovascular adjustment and dysfunction. The aim of the study is to evaluate the cardiac manifestations of severe anemia (Hb<7g%) by echocardiogram. We studied 70 patients for a period of 18 months from September 2013 to March 2015. Echocardiography showed significant increase in left ventricular volume overload. Increase in LV mass seen in most of the patients which was disproportionate to the volume overload state. Seven patients had systolic dysfunction and 16 patients had diastolic dysfunction.

Keywords: Echocardiography, Anemia

1.INTRODUCTION

Anemia is the most common form of nutritional deficiency in both developed and developing countries. In mild cases, patients are asymptomatic. When the anemia is more significant, dyspnea and fatigue may occur. Severe anemia may produce left ventricular dysfunction and overt heart failure.[1]

The clinical, Hemodynamic and compensatory effects of anemia depend upon the following factors[2]:

1. Reduction in the oxygen carrying capacity in blood.
2. The degree of change in the total blood volume.
3. The rate at which the above have developed.
4. The associated manifestations of the underlying disorder that resulted in the development of anemia.
5. The capacity for the cardiovascular and pulmonary systems to compensate for the anemia.

There is growing evidence that anemia contributes to cardiac disease and death. Anemia is an independent risk factor for the development of cardiovascular disease.[3]In patients with heart failure, anemia is associated with increased morbidity. Anemia has also been correlated with the development of left ventricular hypertrophy. When the anemia is corrected, the left ventricular hypertrophy decreases, left ventricular function improves, and hospitalization decrease.

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2.METHODOLOGY

This study was done in 70 patients with severe anemia of hemoglobin less than 7 g% from September 2014 to March 2015 by evaluating the Echocardiographic abnormalities.

Patients aged more than 12 years, those with congestive cardiac failure after treatment and other chronic illness were included in this study. Anemia in pregnancy, patients with diseases like ischemic heart disease, rheumatic heart disease and chronic kidney disease were excluded in the study.

Echocardiogram was done according to American Society of Echocardiography technical guidelines. The various parameters studied were

i) Left and right ventricular internal diameters in systole and diastole (LVIDd, LVIDs, RVIDd, RVIDs)
ii) Fractional shortening
iii) Ejection fraction
iv) Left ventricular mass
v) 'E' wave velocity in m/s (E)
vi) 'A' wave velocity in m/s (A)
vii) E/A ratio
viii) Decelaration time (DT)
ix) Isovolumetric relaxation time(IVRT)

3.RESULTS

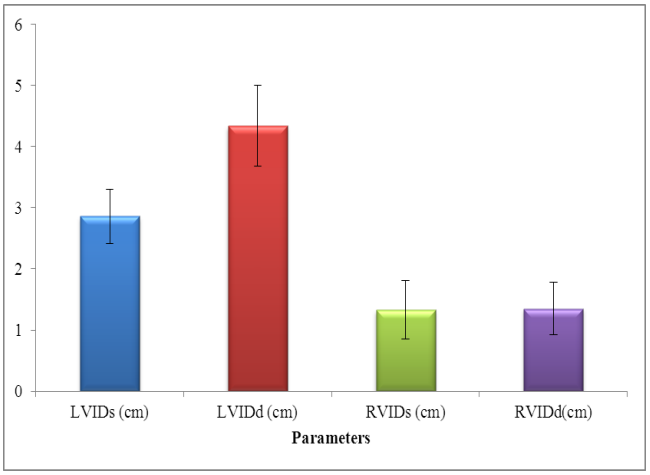
The mean LVIDs was 2.86 ± 0.44 cm, LVIDs was 4.34 ± 0.66 cm, RVIDs was 1.33 ± 0.48 cm and RVIDd was 1.35 ± 0.43 cm (Table 1&Fig. 1). The mean LV mass was 195.75 ± 51.89gm, for male 176.96 ± 42.96gm and for female 208.28

± 53.45gm which was increased in our population. Three patients had mild systolic dysfunction, one had moderate systolic dysfunction and 3 patients had severe systolic dysfunction.

Table 1: ECHO parameters

Parameter	Values	P-value
LVIDs (cm)	2.86 ± 0.44	0.001
LVIDd (cm)	4.34 ± 0.66	0.005
RVIDs (cm)	1.33 ± 0.48	0.025
RVIDd(cm)	1.35 ± 0.43	0.0005
LV mass (gm)	195.75 ± 51.89	0.001
Male (n = 42)	176.96 ± 43.96	0.01
Female (n = 28)	208.28 ± 53.45	0.001
FR shortening (%)	34.67 ± 7.57	0.005
EF (%)	61.26 ± 12.61	0.01

Fig. 1: ECHO parameters



The mean E/A ratio was 1.65 ± 0.62. The mean IVRT was 79.55 ± 16.80 ms and DT was 175 ± 27.29 ms (Table 2). Sixteenpatients had diastolic dysfunction. Among them one had grade I diastolic dysfunction, 5 had grade II diastolic dysfunction and 10 patients had severe (grade III & IV) diastolic dysfunction (Table 3).

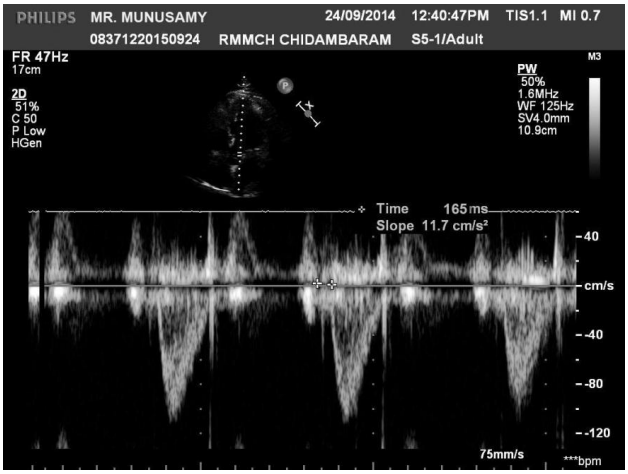
Table 2: Parameter of diastolic function

Parameter	Values	P-value
E (m/sec)	1.01 ± 0.25	0.001
A (m/sec)	0.67 ± 0.26	0.01
E/A	1.65 ± 0.62	0.005
IVRT (ms)	79.55 ± 16.80	0.05
DT (ms)	175.00 ± 27.29	0.001

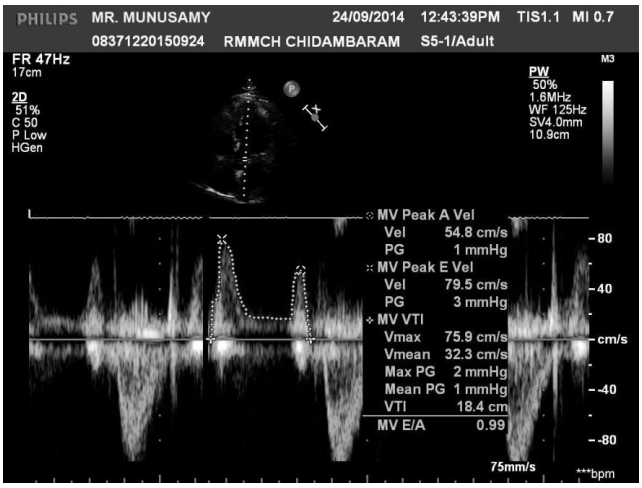
Table 3: Patients with diastolic dysfunction

Parameter	Number of Patients
Grade I	1
Grade II	5
Grade III and IV	10

ECHO FINDINGS



Measurement of DT



Measurement of EA ratio

4.DISCUSSION

This study was done to assess the cardiac function in severe anemia by 2D ECHO. The patient group consisted of 70 severely anemic individuals with hemoglobin less than 7gm%. The study group included twenty eight males and forty two females and most of them had nutritional anemia.

ECHOCARDIOGRAPHIC PARAMETERS

Dimensions and volumes:

The LVIDs in anemic patients was significantly higher compared to controls. Left ventricular end systolic volume and systolic radius/ thickness ratio was also significantly increased in anemia. Compared to controls in the present study the anemic patients had significant increase in LVIDd. End diastolic volume/ thickness ratio was also significantly higher than that of controls. These findings reflect the changes in end diastolic volume in severe anemia and are suggestive of a chronic volume overload state, a known

feature of chronic severe anemia. The RVIDs and RVIDd was also increased in severe anemic patients.
The septal thickness in systole and diastole did not show any significant changes. The end systolic volume as measured by Simpson's method was increased in our study. The end diastolic volume also showed an increased value. This represents the increase in preload, which is seen in chronic severe anemia. This finding suggests a role for the Frank-Starling mechanism in the hyperdynamic state of chronic anemia.

The LV mass is significantly increased in patients with severe anemia (P<0.001). The mean LV mass in the study group was 195.75 ± 51.89gm, for male 176.96 ± 42.96gm and for female 208.28 ± 53.45gmwhich is suggestive of hypertrophy. Trivedi et al studied leftventricular mass in normal Indian population and found that the left ventricular mass in men was found to be 124 ± 32gm in males whereas in women it was 93 ± 37 gm. This is much lower than the American Society of Echocardiography guidelines for normal LV mass (Males- 148±26gm; Females- 108±21gm). The increased LV mass reflects a hypertrophic response to chronic volume overload state, which is well documented in literature.

Evaluation of systolic function

The percentage of fractional shortening and ejection fraction did not show significant differences. This finding in conjunction with increased end diastolic volume suggests that Starlings forces play an important role in the compensatory mechanisms seen in chronic severe anemia.

Seven patients had systolic dysfunction in our study. The low incidence of systolic dysfunction can be explained by the case selection in this study.

In patients with chronic severe anemia the increased preload and a decreased afterload (decreased blood pressure, hyperkinetic circulatory state) are the basic compensatory mechanisms. Due to these changes, the indices of left ventricular function are set at a higher level in the compensated state. Decompensation, therefore probably occurs at a higher level of these indices as compared to normal individuals.

Evaluation of diastolic function

Diastolic dysfunction has been a variable finding in literature. Initial studies had not found diastolic dysfunction in severe anemia as compared with controls.[4,5]Later studies have shown diastolic dysfunction in severe anemia.[6,7,8] In this study, the early(E) and late (A) diastolic flow velocity were increased. This finding concurred with the study of Bahlet al.[4] This can be explained by the hyperdynamic state of flow present in severe anemia. In our study 16 patients had diastolic dysfunction. Among them 1 had grade I diastolic dysfunction, 5 had grade II diastolic dysfunction and 10 had grade III & IV diastolic dysfunction. This is a significant finding in our study. The development and severity of diastolic dysfunction was not correlating with the severity of anemia and sex of the patient.These finding differ from that of the previous studies by Bahl et al[4]and Aessopos et al[5] but was present in the study by Sluhotska et al.[6] The implication of this finding of diastolic dysfunction in severe anemia is not very clear. There is a theoretical possibility that diastolic dysfunction can occur in chronic anemia as a consequence of tissue hypoxia.[9] Results of study on coronary blood flow in such patients have shown a decrease in myocardial oxygen consumption despite an increase in myocardial workload and oxygen extraction. Although myocardial ischemia exemplified by coronary artery disease is a well-established cause of diastolic dysfunction, the influence of hypoxia per se, in patients with chronic anemia is less clear.

5.CONCLUSION

- ✓ Severe anemia leads to hyperdynamic circulation and chronic volume overload state and causes significant changes in echocardiographic parameters.
- ✓ Careful comparative analysis of sensitive markers of left ventricular function revealed significant left ventricular dysfunction in chronic severe anemia.
- ✓ Evidence of systolic dysfunction on the left ventricle in the form of increased left ventricular internal diameter in systole, and volume, circumferential wall stress, and end systolic wall stress was present.
- ✓ Evidence of significant diastolic dysfunction was noted and the severity of diastolic dysfunction was unrelated to the severity of anemia and the sex of the patient.

6.REFERENCES

1. Hunter, A. The heart in anemia. Quart. J. Med. 1945; 14: 107.
2. Murray A Varat, Robert J.Adolph, Noble O Fowler, Cardiovascularеffects of anemia; American Heart Journal :1972; 83: 415 - 426.
3. Sanghvi, LM, R. Sharma and SN Misra. Cardiovascular disturbances in chronic severe anemia. J American Heart Association 2015; 373-378. Doi:101161/01.cir15.3.373.
4. Bahl, V.K., O.P Maihotra, D kumar ,R Agarwal ,K.C Goswami, R Bajaj, S.Shrivastava; Non invasive assessment of systolic and diastolic left ventricular function in patients with chronic severe anemia. American Heart Journal, 1992; 124: 1516 -23.
5. Aessopos A, Deftereos S, Farmakis D, Corovesis C, Tassiopoulos S, Tsironi M, Georgonikou D, Moyssakis J; Cardiovascular adaptation to chronic anemia in the elderly: an echocardio graphic study. Clin Invest Med. Oct 2004; 27(5):265-73.
6. Sluhots'ka, IB, NM Serediuk, IP Vakaliuk, AM Siema; Clinical and hemodynamic characteristics of heart dysfunction in patients with iron deficiency anemia. (Russian - Abstract) UkSprava, 2002; 141-142.
7. Mohammed Abd Abdul Hussein. Relationship between Anemia and Diastolic Dysfunction of the Heart. Medical Journal of Babylon 2012; 9(1): 166-181.
8. Zile MR, Brustsaert DL. New concepts in diastolic dysfunction and diastolic heart failure. Part I: diagnosis, prognosis and measurements of diastolic function. Circulation. 2002; 105: 1387-93.
9. Nikita Hegde, Michael W. Rich, CharinaGayomali. The Cardiomyopathy of Iron Deficiency. Tex Heart Inst J. 2006; 33(3): 340-344.

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