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An echocardiographic study of cardiac functions in patients of severe anemia

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Abstract
Anemia is world's second leading cause of disability and widely prevalent among all age groups. Studies done in patients with diabetes, CKD or CAD have supported an association between anemia and left ventricular diastolic dysfunction. The current study was undertaken to seek whether low Hb level is related to Left ventricle structure and left ventricle filling pressure in patients. Total 60 patients, 30 with severe anemia and 30 normal subjects were taken using simple random sampling. All patients were subjected to various investigations such as CBC, PBF, Chest X-ray, ECG, 2Dechocardiography etc. Data study findings show significant changes in terms of cardiac functions such as left ventricle end diastole dimension EDV, SV, EF, CO, Cardiac index, left ventricle mass index etc. in study group as compared to control group. Based on the findings of the study it was concluded that conventional echocardiography is a simple test for detecting left ventricular dysfunction in patients of severe anemia and suggest the need for correction of anemia to reverse and prevent left ventricular dysfunction.

Keywords: Anemia, echocardiography, cardiac functions, left ventricular dysfunction

1. Introduction
Anemia is major public health problem and remains one of the most prevalent and enfeebling morbidities suffered by individuals in the developing world and is a critical co morbid factor contributes to the excess mortality in these regions [1]. The WHO Global Database on Anemia estimated the prevalence of anemia worldwide at 25 % with the prevalence being as high as 43% in the developing countries [2, 3]. Africa and Asia account for more than 85% of the absolute burden in the high risk groups and India is the worst hit affecting 74.3% of population [4]. Anemia reduces oxygen delivery to tissue and causes a compensatory cardiovascular response [5].

Anemia has been convincingly shown to be a powerful predictor of rehospitalization rates and survival in chronic heart failure [6]. Hemodynamic changes accompanying severe anemia include increased preload, reduced peripheral vascular resistance, and increased cardiac output. These adaptive responses may ultimately lead to a detrimental increase in the left ventricular mass.

Anand *et al.* [7] have reported that 1gm/dl increase in hemoglobin concentration is associated with 4.1gm/m2 decrease in the left ventricular mass index during 24 week period.

Anemia has shown to be associated with reversible elevations in plasma catecholamines and alpha 2 receptors density among patients with renal failure. Finally, chronically increased myocardial work and adrenergic stimulation caused by decreased oxygen carrying capacity may ultimately lead to progression of heart failure and may accelerate adverse ventricular remodeling [8].

Several studies in patients with diabetes, chronic kidney disease or coronary artery disease have supported an association between anemia and left ventricular diastolic dysfunction [9-11].

The purpose of present study is to seek whether low hemoglobin level is related to left ventricular structure and left ventricular filling pressure in patients.

2. Review of Literature

Hussain *et al.* [12]. Conducted a transthoracic Doppler echocardiographic study in 200 patients to evaluate the relationship between anemia and diastolic dysfunction of the heart. Among the anemic group 12 participants had left ventricular hypertrophy while no subject from the control group had left ventricular hypertrophy. The correlation was statistically significant. Among these participants who had diastolic dysfunction, 6 participants were having left ventricular hypertrophy and 2 participants had not. The correlation between left ventricular hypertrophy due to anemia and diastolic dysfunction was statistically highly significant.

Simsek H *et al.* [13]. Studied 97 patients who had iron deficiency anemia and 50 healthy subjects. Compared to control group, patients with iron deficiency anemia showed significantly longer maximum P wave duration, P wave dispersion, mitral inflow deceleration time and isovolumetric relaxation time. Based on the findings study concluded that Iron deficiency anemia may be associated with prolonged wave duration and dispersion as well as impaired diastolic left ventricular filling.

Nair D *et al.* [10] performed a cross sectional study to evaluate the association of anemia with diastolic dysfunction and left ventricular hypertrophy in outpatients who had coronary artery disease. The prevalence of diastolic dysfunction ranged from 8% of participants who didn't have anemia to 13% in those who had moderate anemia to 24% in those who had severe anemia. Anemia was found to be strongly associated with diastolic dysfunction but not with left ventricular hypertrophy in this community based sample of outpatients who had established coronary disease.

Dasarthy *et al.* [14] studied thirty patients of severe anemia and observed an increase in LV end diastolic volume, pre ejection period index and isometric contractions. There was increased LV mass, non-compliance of LV, increased cardiac output and cardiac index.

3. Methodology

This study was conducted at M.M. Institute of Medical Sciences and Research, Mullana, Ambala. Total 60 patients were selected from OPD and indoor wards of medicine department using simple random sampling. Out of 60 patients, 30 patients of severe anemia (Hb<7gm/dl) between 20-50 years of age comprised Group 1 (Study group). Group 2 (Control group) comprised of 30 age and sex matched normal subjects. All patients were subjected to detailed history and systemic examination after taking consent. They were subjected to various investigation such as CBC, PBF, Reticulocytes count, MCV, MCH, MCHC, Platelet count, BT, CT Serum creatinine, Urine examination, RBS,TSH, Bone marrow aspiration,(wherever indicated), USG abdomen(in patients with raised(serum creatinine), Chest X-ray, ECG and 2D echocardiography.

Patients with underlying disorder of cardiovascular system, DM, Thyroid, CRF, and chronic respiratory distress were excluded from the study. Subjects were treated as per standard treatments schedule except beta blockers, which were withheld one week before echocardiographic study.

3.1 Data Analysis

Statistical analysis was done using percentage, mean values, standard deviation, standard errors, Chi^2 test with yates correction, and unpaired t test, p values <0.005 was considered statistically significant and of <0.001 was considered statistically highly significant.

4. Results

- The mean age in group 1 was 31.3±8.65 years as compare to 32±8.77 years in group 2. Male: female ratio being 0.42:1.
- 63.33% of the patients had microcytic hypochromic picture in the peripheral blood film. Mean hemoglobin in anemic case group was 2.5-5.5gm/dl and in control group was 11-13 gms/dl.
- Cardio thoracic ratio was significantly more in patients with severe anemia when compared to control group (p<0.001)
- EA ratio being the most sensitive and specific parameter for diastolic dysfunction was 1.1±0.19 in group 1 and 1.22±0.12 in group 2. The difference was statistically significant (p<0.005)
- Mean of DT of E was 183.73±28msec in group 1 and 170.32±17.19 msec in group 2. The difference was statistically significant (p<0.05)
- The mean IVRT of 97.64±15.12 msec was significantly higher in group 1 as compared to85.46±11.01 msec in group 2 (p<0.01)
- In group 1 13.3% patients were found to have diastolic dysfunction. None in the group 2 have diastolic dysfunction.
- In group 1, 56.5% had left ventricular hypertrophy while none from the group 2 had left ventricular hypertrophy of the anemic patients (group1) who had LVH, 23.5% had diastolic dysfunction. Among the remaining without LVH, none had diastolic dysfunction.

Table 1: Showing left ventricular dimensions n=60

Dimensions (mm)	GROUP 1		GROUP 2		p value
	Range	Mean±SD	Range	Mean±SD	
LVIDd	41-61	50.2±5.55	40-56	47.16±5	<0.05
LVIDs	24-41	31±5.05	25-41	30.3±3.81	>0.1
IVSd	6-12	8.52±1.64	6-11	8.12±1.42	>0.1
IVSs	12-20	12.3±3.2	9-15	12.4±1.47	>0.1
LVPWd	6-14	8.48±1.98	6-11	8.2±1.44	>0.1
LVPWs	10-18	14.1±2.23	10-17	13.3±1.84	>0.1

Table 2: Showing Left Ventricular Indices n=60

LV Index (%)	GROUP 1	GROUP 2	p value
EF	74.5 ±10.1	71.32 ±8.29	>0.05
FS	36.5 ±9.63	31.56 ±7.74	<0.05

Table 3: Showing left ventricular mass and left ventricular mass index n=60

Parameter	Group 1	Group 2	p value
LV Mass (gm)	193.4±63.51	155.38±40.27	<0.05
LV Mass Index(gm/m^2)	128±45.74	96.83±12.33	<0.01

Table 4: Showing hemodynamic parameters n=60

Parameter	Group 1	Group 2	p value
Heart rate (bpm)	89.52±14.58	77.4±8.82	<0.01
Cardiac Output (l/min)	8.2±3.01	5.87±1.51	<0.01
Cardiac Index (l/min/m^2)	5.52.24	3.43±0.76	<0.001
PVR	11.32±4.73	15.02±3.93	<0.001

5. Discussion

In present study, cardiac output as well as cardiac index was significantly higher as validated by studies done of cardiac functions in anemia. The high cardiac output may be because of various factors such as increased preload as evidenced by increased LVIDd, increased myocardial contractility, afterload reduction by decreased vascular resistance and blood viscosity, increased heart rate.

LVIDd in patients with severe anemia was found to be 50.2±5.55 mm as compared to 47.16±5mm in control group (p<0.05). These findings were consistent to the studies done by Takahashi M *et al.* [15] and Bahl *et al.* [16].

Left ventricular diastolic volume (EDV) was increased in anemic patients than controls in present study, which means an increase in preload responsible for high cardiac output state of anemia. These findings are in accordance with the studies undertaken by Takahashi M et.al and Panwar *et al.* [17].

There are conflicting reports of Ejection Fraction in literature while Bahl *et al.* [16]. And Panwar *et al.* [17]. Noted a decreased EF in anemic subjects, Khan *et al.* [18] found EF to be increased. In the present study EF was found to be insignificantly raised because of increased preload, better myocardial contractility and decreased afterload.

The detrimental effect of anemia on diastolic functions of the heart as observed in present study was consistent with Hussein *et al.* [12]. Who demonstrated the impact of anemia on diastolic function and showed a correlation between anemia and left ventricular filling disturbances.

There was a statistically high association between anemia and left ventricular hypertrophy. This was consistent with Hussein *et al.* [12]. Who had examined the relation between anemia and LVH.

A highly statistical correlation between LVH due to anemia and diastolic dysfunction of the heart had been found in the study. This was consistent with studies predominantly done in cohorts that had established kidney disease that found anemia to be linked to LVH.

6. Conclusion

Cardiac dysfunction, predominantly involving LV diastolic function is not uncommon in patients with severe anemia. Left ventricular mass is found to increase in patients of severe anemia. Features of congestive heart failure may develop in patients of anemia with significant increase in LV mass which leads to decreased compliance and diastolic dysfunction. Conventional echocardiography is a simple test for detecting LV dysfunction in patients of severe anemia and suggests the need for correction of anemia to reverse and prevent left ventricular dysfunction.

7. References

1. Bruno de Benoist *et al*., World Health Organization worldwide prevalence of anemia 1993-2005.Geneva: World Health Organization, 2008.
2. Worldwide prevalence of anemia WHO Global Database on anemia, 1993- 2005.
3. McLean E, Cogswell M, Egli 1 *et al*. Worldwide prevalence of anemia, WHO vitamin and Mineral Nutrition Information System, 1993-2005.
4. Gupta Anuradha *et al*. NRHM (guidelines for control of iron deficiency anemia) Jan, or source: WHO Global Database on Anemia, 2013, 5-6.
5. Fauci anthony S *et al*. Harison's Principles of Internal Medicine.17th ed. United states: McGraw-Hill Professional, 2008, 156-60.
6. Franz WM, Muler OJ, Katus HA. Cardiomyopathies: from genetic to the prospect of treatment. Lancet, 2001; 358(9293):1627-37.
7. Anand I, McMurray JJV, whitmore J *et al*. Anemia and its relationship to clinical outcome in Heart failure. Circulation, 2004; 110:149-54.
8. Willliam G. Dec anemia in heart failure time to re think its etiology and treatment. Journal of American College of cardiology. 2006; 48(120):2490-2492.
9. Srivastava PM, Thomas MC, Calafiore P, Macisaac RJ, Jerums G, burrel LM. Diastolic dysfunction is associated with anemia in patient with type II diabetes. Clinical Science London, 2006; 110:109-116.
10. Nair D, Shilpak MG, angeja B, Liu HH, Schiller NB, Whooley MA. Association of anemia with diastolic dysfunction is associated with anemia in patient with coronary artery disease in the heart and Soul study. American Journal of cardiology. 2005; 95:332-336.
11. Sarnak MJ, Tighiouart H, Majunath G, MacLeod B, Griffith J, Salem D *et al*. Anemia as a risk factor for cardiovascular disease in the Athrosclerosis risk in communities (ARIC) study. Journal of American College of cardiology. 2002; 40:27-33.
12. Hussein Mohammed Abdul. Relationship between anemia and diastolic dysfunction of heart. Medical journal of Babylon. 2012; 9:1.
13. Simsek H *et al*. The effects of iron deficiency on p wave duration and dispersion. Clinics (sao Paulo). 2010; 65(11):1067-71.
14. Dasarthy S, Setheraman KR. left ventricular dysfunction in chronic severe anemia: an echocardiographic study. Journal of association of physician of India. 1988; 36:59-60.
15. Takahashi M, Kurokawa S, Tsuyusaki T, Kikawada R. Studies of hyperkinetic circulatory state in chronic anemia. Journal of cardiology. 1990.20(2):331-9.
16. Bahl VK, Malhotra OP, Kumar D, Agarwal R, Goswami KC, Bajaj R *et al*. Noninvasive assessement of systolic and diastolic left ventricle function in patient with chronic severe anemia : A combined M mode, two dimensional and Doppler echocardiographic study. American Heart Journal. 1992; 124(6):1516-23.
17. Panwar RB, Goyal R, Shukla RP, Misra SN. Assessment of left ventricle function in chronic severe anemia. An echocardiographic study. Journal of association physician India. 1991; 39(9):673-4.
18. Khan HS, Ahmad M, Zaidi HR, Azmal MR, Rabbani MV, Khan AS. Some echocardiographic findings in patients of anemia abst. Journal of association of physician of India. 1989; 39(11):897- 98.