

A Study of the Impact of Anemia on Morbidity and Mortality in Children with Dilated Cardiomyopathy

Mohammed Ammar, Osama Mahmoud El-Asheer, Nagwa Ali Mohammed
Pediatrics Department, Faculty of Medicine, Assiut University, Assiut, Egypt.

Corresponding Author: Mohammed Ahmed Ammar

E-mail: 1234mohammed.ammar@gmail.com

Abstract:

Introduction: A history, physical examination, and noninvasive tests are used to make the clinical diagnosis of dilated cardiomyopathy (DCM), which is a heart muscle disease marked by systolic dysfunction and dilatation of the left or both ventricles.

Aim: To determine the influence of anemia on morbidity and mortality in children with DCM, with or without heart failure, and its correlation with the clinical and echocardiographic findings.

Patient and Methods: This was a longitudinal prospective study to assess the impact of anemia on children and adolescents known to have dilated cardiomyopathy attending Assiut University Hospital. Cardiomyopathic patients were divided into two groups (anemic and non-anemic), and both groups underwent clinical and echocardiographic evaluation at the beginning and after a minimum of four months. All infants, children, and adolescents with dilated cardiomyopathy who were diagnosed clinically and by echocardiography were included.

Results: Symptoms and signs of heart failure were observed more often among anemic patients. On follow-up of the cardiomyopathic anemic group after 4 months of treatment of anemia, we found that with increased hemoglobin level, there is a significant improvement in symptoms and signs of heart failure, and a significant increase in left ventricular systolic function (FS %) detected by echocardiography.

Conclusion: Treatment of anemia in patients with cardiomyopathy resulted in a significant increase in left ventricular systolic function (FS %) detected by echocardiography and improved manifestations of heart failure.

Keywords: Anemia; Echocardiography; Cardiomyopathy.

Introduction:

Dilated cardiomyopathy (DCM) is a heart muscle disease presented by systolic dysfunction and ventricular dilation of the left side or bilateral. It is a main cause of heart failure that requires a heart transplant in the future [1].

Onset of DCM is usually acute in as many as 25% of cases; however, in 50% of cases, there is a history of preceding viral illness [2].

History, physical examination, and noninvasive procedures are necessary to diagnose dilated cardiomyopathy clinically. Signs of respiratory distress resulting from

pulmonary and systemic venous congestion are the first clinical symptom [3].

Doppler examinations and echocardiography are the primary methods used to diagnose DCM. They are the most illuminating noninvasive diagnostics for determining the kind of cardiomyopathy and the extent of heart muscle dysfunction [2]. One of the main issues facing DCM patients is growth abnormalities, which can be brought on by a number of conditions such as increased energy demand, gastrointestinal malabsorption, decreased food intake, or psychological issues [4].

Children with DCM frequently suffer from anemia, which is linked to a higher risk

of morbidity. Specifically, iron deficiency anemia has been linked to the development of secondary cardiomyopathy [5].

Although anemia is frequently seen in heart failure patients, its actual incidence is unclear and unreported in the pediatric literature, which is currently under publication. Anemia struck 64 percent of DCM patients in a retrospective study. Anemia is common in DCM patients of all ages and without regard to gender. Age has no bearing on the occurrence or severity of anemia [6].

Aim:

To determine the influence of anemia on morbidity and mortality in children with DCM, with or without heart failure, and its correlation with the clinical and echocardiographic findings.

Patients and Methods

Study Setting:

This was a longitudinal prospective study to assess the impact of anemia on children and adolescents known to have dilated cardiomyopathy attending Asyut University Hospital.

Clinical trial number: NCT03214757

Inclusion criteria:

- All infants, children, and adolescents with dilated cardiomyopathy who were diagnosed clinically and by echocardiography.

Exclusion criteria:

- Infants aged less than 2 months
- Patients with any hemolytic anemia
- Patients with congestive heart failure due to causes other than dilated cardiomyopathy
- Patients with congenital heart disease.

Methodology:

- Cardiomyopathic patients were classified into two groups (anemic and non-anemic) according to hemoglobin level.
- Both groups underwent clinical and echocardiographic assessment initially and after at least 4 months of treatment.
- The impact of anemia was measured by clinical and echocardiographic improvement or deterioration.

- History was obtained for poor suckling, feeding difficulties, irritability, dyspnea, palpitation, and frequency of admission to the NICU.
- Anthropometric measurements were obtained for all cases, including weight, height or length, and head circumference.
- Vital signs involving pulse, blood pressure, respiratory rate, and temperature were accurately measured.
- Systemic examination of patients for pallor, jaundice, cyanosis, jugular venous pressure, lower limb edema, and hepatomegaly was performed.
- Careful cardiac examination was performed.
- Complete blood count, serum iron and ferritin levels, and total iron binding capacity were done to diagnose and detect the type of anemia.
- After the initial assessment, anemic patients were expected to receive four months of treatment before the second reassessment.
- Detailed Colored Doppler 2-D echocardiography was made for all patients initially and on follow-up four months later.

Statistical Analysis:

- Data were collected from the patients' clinical interpretation at presentation and medical records.
- A two-tailed $p < 0.05$ was considered statistically significant. All analyses were performed with the IBM SPSS 26.0 software.

Ethical Considerations:

- Approval from the Ethics of Scientific Research Committee, Faculty of Medicine, Assiut University was obtained.
- Verbal and written consents were obtained from all the patients' caregivers.
- The privacy and confidentiality of all information obtained were observed without intervention in the prescribed treatment.

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Results:

This study involved 40 dilated cardiomyopathic patients; 20 of them were anemic. All patients (40/40) received anti-heart failure measures, in addition to 4 months of treatment for anemia.

Table (1): The Descriptive data of the cardiomyopathic patients studied
(n = 40)

Descriptive data	No.	%
Sex		
Male	22	55
Female	18	45
Age (year)		
Median (IQ)	3.75 (1.5 - 10)	
Weight (Kg)		
Median (IQ)	14.25 (7.6 - 25.8)	
Height (cm)		
Median (IQ)	100 (66.3 - 138)	
Head circumference (cm)		
Median (range)	49.5 (45.3 - 52)	
BMI (2 - 16 years), (n=29)		
Range	9.2 - 36.1	
Median (IQ)	14.6(13.6 - 15.8)	

Clinical findings in anemic and non-anemic groups, and also in the anemic group initially and on follow-up, as shown in Figures (1) and (2)

When comparing non-anemic and anemic groups as regards clinical findings,

most clinical manifestations of heart failure were more obvious among the anemic group on initial assessment, while on further assessment, "after four months of treatment of anemia," we noticed significant improvement of previous manifestations.

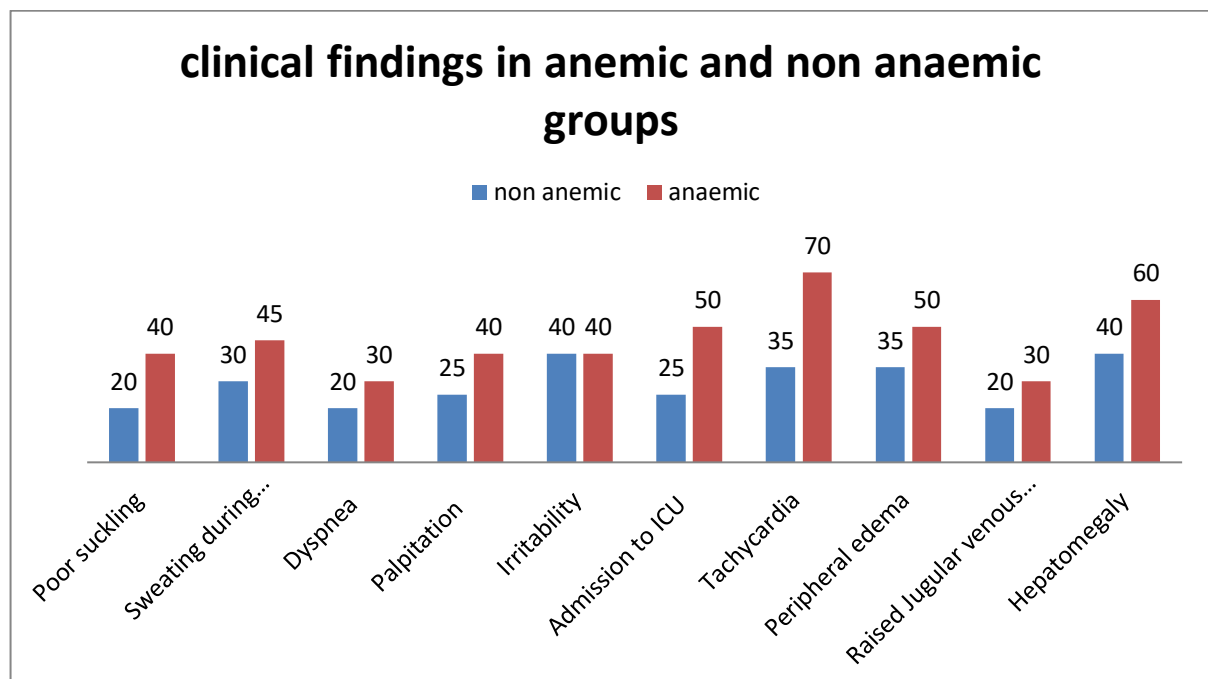


Fig. 1: A comparison between non-anemic and anemic cardiomyopathic age groups, in relation to clinical findings

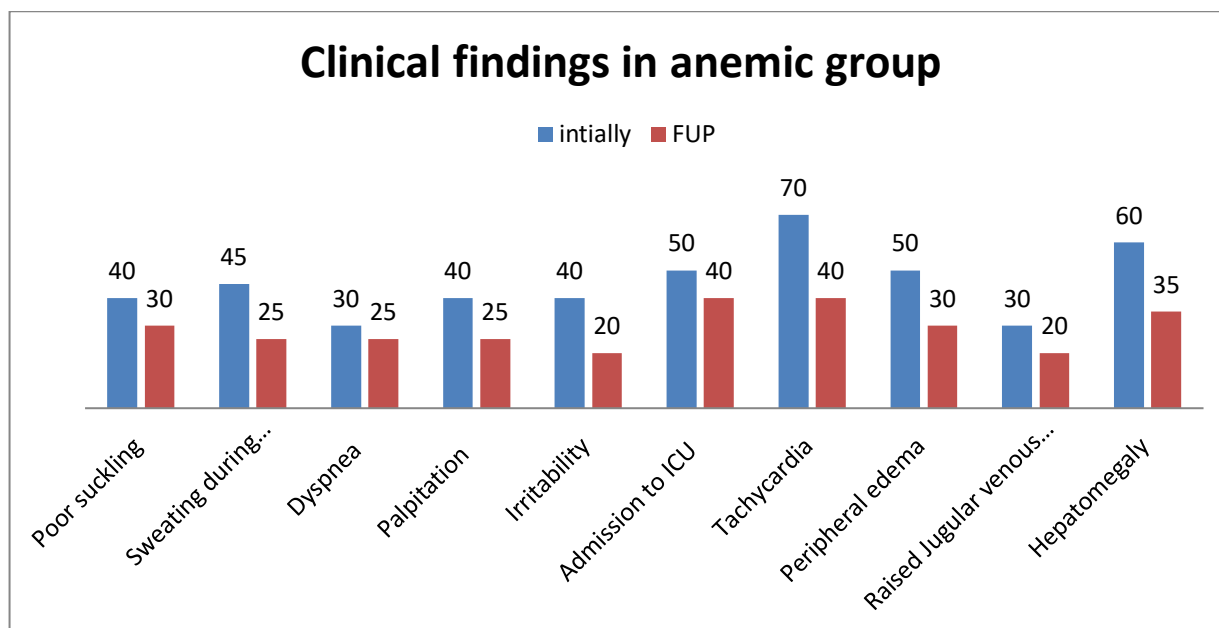


Fig. 2: comparison between initial and follow-up clinical findings in the anemic group

Table (2): A comparison between cardiomyopathic anemic patients, initially and on follow-up, in relation to echocardiographic parameters

Echocardiographic parameters	Cardiomyopathic anemic patients		
	Initially (n=20)	follow up (n=17)	P. value
	Mean $\pm$ SD	Mean $\pm$ SD	
AO (mm)	17.54 $\pm$ 5.37	17.95 $\pm$ 5.17	0.81
LA (mm)	30.5 $\pm$ 11.76	30.56 $\pm$ 11.38	0.99
LVES (mm)	41.45 $\pm$ 13.41	38.21 $\pm$ 13.37	0.31
LVED (mm)	50.24 $\pm$ 14.17	50.57 $\pm$ 13.45	0.94
IVS (mm)	6.01 $\pm$ 1.72	6.03 $\pm$ 1.7	0.98
LVPW (mm)	6.18 $\pm$ 1.86	6.2 $\pm$ 1.82	0.93
LV FS (%)	17.24 $\pm$ 3.62	19.42 $\pm$ 3.91	0.014
LV E/A	0.2 $\pm$ 0.07	0.2 $\pm$ 0.06	0.72

There was a significant improvement in left ventricular systolic function (FS %) after 4 months of anemia treatment.

Discussion

A total of 40 patients (infants, children, and adolescents) with DCM were recruited for the study. Those patients were divided into two equal groups: those with anemia and those without. The interquartile (IQ) median age of those patients was 3.75 (1.5-10) (years), the number of males was 22 (55%), while the number of females was 18 (45%).

In line with the current study, a previous study enrolled 218 children with DCM.

Their median age was 6 years, ranging from 1 day to 15.8 years [7]. Also, another study enrolled 55 cases with a mean age of 4.06 ± 5.6 (years). The majority (51%) of them were males. Of them, 35 (63.6%) children had anemia [8].

Recently, Luxford et al studied 138 patients with DCM; the mean (SD) age at the time of study was 5.8 ± 5.2 years old, and 26 (53%) were female [9].

In the current study, tachycardia, hepatomegaly, and peripheral edema were the most common symptoms (70%, 60%,

and 50% of patients); dyspnea was only reported in 30% of cases. In contrast, Chelo et al. reported that dyspnea on exercise was the most common complaint in their study [10].

The most common complaint of heart failure is dyspnea during exertion. However, it is overlooked when patients, like those in this research, come late with complications, parents' ignorance of heart disease symptoms, or miscalculation of the illness's severity. Nurses at various health centers are the first to encounter children brought by their parents; thus, teaching them about some aspects of emergent cardiac presentations is vital. Most healthcare professionals ignore these signs, contributing to the diagnostic delay [10].

On follow-up of the anemic group, it was found that increased hemoglobin level leads to some significant echocardiographic changes, as increased left ventricular systolic function (FS%), but with no significant changes in the other echocardiographic parameters related to the cardiac chamber dilatation or thickness.

Regardless of the existence of anemia, a number of studies have documented better cardiac function in certain children with DCM throughout follow-up. Depending on the criteria of improvement and the underlying etiology of DCM, the incidence of cardiac improvement can range from 16% to 63% [11]. To the best of our knowledge, this is the first research to assess the impact of anemia medication on echocardiography results in individuals with DCM across various age groups.

According to the Australian data, none of the patients who had normal LV function and size at follow-up experienced any decline in function, transplantation, or death. So, it's still unclear who needs continuous monitoring or medication. Are these children at risk for recurrent heart failure, or is it only a subset of children at risk who have persistent abnormalities [12]?

Conclusion:

Patients with dilated cardiomyopathy who had anemia treatment showed a substantial improvement in several

echocardiographic parameters (increased FS%) as well as an improvement in some heart failure symptoms.

Recommendations:

- Early identification and treatment of concomitant conditions, such as anemia, in children with dilated cardiomyopathy slows the course of the illness.
- Children with cardiomyopathy often have anemia, which exacerbates the illness; it is crucial to identify the reason and provide appropriate care for these individuals.
- Echocardiography and a periodic ECG are crucial for monitoring heart function in individuals with cardiomyopathy, particularly those who are anemic.
- More research with a larger sample size and a longer time frame is advised to better understand the effects of anemia on children with dilated cardiomyopathy.

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