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EFFECT OF ANEMIA OVER CYANOTIC CONGENITAL HEART DISEASE- A STUDY FROM EASTERN INDIA

Pediatrics

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KEYWORDS

Anemia, Cyanotic Congenital Heart Disease

INTRODUCTION:

Cyanotic congenital heart disease (CCHD) includes a heterogenous population with persistent venous and arterial mixing at atrial, ventricular or arterial level and results in chronic hypoxemia and central cyanosis. Iron is essential componwnt of hemoglobin production and sufficient iron stores are required for adequate hemoglobin concentration. More than one third patients of cyanotic heart disease are iron deficient. [1,2]. Possible causes of iron deficiency include increased iron consumption through increased erythropoiesis,inappropriate venesections, abnormal hemostasis, limited dietary intake or absorption,. Iron deficiency anemia in patients with CCHD is a major problem because it causes increments in tissue hypoxia and blood viscosity and is associated with a tendency to develop metabolic acidosis, hypercyanotic attacks and thromboembolic events.[3] Iron deficiency has also been identified as a risk factor for cerebrovascular events [4]

The present study, carried out in a tertiary centre of eastern India, aimed to describe prevalence, impact of anemia in patients of CCHD .

AIMS:

1. To study the presenting complain of patients with cyanotic congenital heart disease (CCHD) aged 0-12 year who are admitted in pediatric unit of R.G.Kar Medical College & Hospital.
2. To determine the proportion of anemia among the study population.
3. To find out relation of anemia with presenting complain of study population , if any.

METHODS OF DATA COLLECTION:

All children admitted in the Pediatric department of a tertiary centre of eastern India over a priod of 1 year with suspected and proven CCHD were included in this study after obtaining written consent from parents. This study was approved by the Ethical committee of the centre.

Confirmation of the structural heart defect was done via 2 dimensional echocardiogram at Cradiac Unit of the centre as well as looked for associated chamber enlargement, pulmonary hypertension, pulmonary and systemic blood flow ratio, and ejection fraction. On admission, 2 ml of blood sample collected and tested for hemoglobin, MCV, PCV.

PELOD score was assessed at admission. Patients were classified in functional heart failure classes according to Modified Ross classification.

Patients with anemia who survived, at the time of discharge, were given oral iron therapy at 3 mg per kg daily as ferrous sulphate preparation. They were followed up after 3 months for improvement of hemoglobin status, functional heart failure class, weight and echocardiographic demonstration of change of any chamber size.

Statistical Analysis:

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS 24.0. andGraphPad Prism version 5. A chi-squared test ($\chi 2$ test) was any statisticalhypothesis test wherein the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true. Without other qualification, 'chi-squared test' often is used as short for Pearson's chi-squared test. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate.p-value ≤ 0.05 was considered for statistically significant.

RESULTS:

Total 45 children with confirmed CCHD were included in the study with mean age of 31.22 ±22.80 months (range-4 month to 76 months). 66.7% (n=30) was male in the study population. Majority of the patients was from lower socioeconomic class (60%) (n=24) and 27.5% (n=11) from lower middle class. Children of 1-3 years of age group is highest, consisting 40%(n=18); infants being 26.7% (n=12), children between 3-6 years of age group was 33.3% (n=15). Tetralogy of Fallot (TOF) was most common cardiac defect(37.8%) (n=17). Others being TGA-VSD 15.6% (n=7), TA-VSD-PS 13.3% (n=6), DORV-PS 8.9% (n=4), PA-VSD 8.9% (n=4), TAPVC 2.2% (n=1), TOF-MAPCA 6.7% (n=3), TA-ASD 2.2% (n=1), Ebstein anomaly 2.2% (n=1). 26 patients (57.8%) presented with hypercyanotic spell, while 12 patients (26.7%) presented with cyanosis on exertion and 11.1% (n=5) with heart failure, 2 (4.4%) diagnosed as cerebral thrombosis.

26 patients (55.6%) were found to be anemic. Significant difference in hemoglobin, PCV, MCV, MCH was present among anemic and nonanemics. Among 26 children with cyanotic spell, 18 (69.2%) had anemia, which was significant (p=0.039). 4 patients with TGA-VSD and 1 patient with TAPVC presented with features of heart failure. Among them, 4 patients were anemic . Mean PELOD score was higher among anemics than nonanemics (4.44±4.35 v/s 9.1±4.49), which is significant (p value <0.05). Anemia was not significantly found to be associated with higher Qp/Qs ratio (mean 1.50±0.70 v/s 1.48±0.70 ; t-test=0.09; p value=0.92). Among the anemics, 47.6% (n=10) belonged to Modified Ross class 4 and 52.4% (n=11) in class3, compared to 15.8% (n=3) , 57.9% (n=11), 26.3% (n=5) of nonanemics in class 4,3 and 2 respectively. Anemia was significantly associated with prolonged hospital stay. Mean hospital stay of anemic was 7.88±2.86 days v/s 4.64±2.49 days (t-test=3.55, p=<0.05). Total 10 patients expired, 7 of them had anemia (p=0.473, not significant).

Among the surviving patients who had anemia; after 3 months post discharge of oral iron therapy, there is significant improvement of Hb level (post treatment-14.98±1.55 v/s pretreatment-13.09±0.81 ; p value <0.05). There was significant increase in body weight (mean body weight post-treatment 11.05±3.41 kg v/s 10.63±3.28 kg; t test=-4.27 p value<0.05) with upward growth velocity curve noted among 76.9% (n=10) of those with improved Hb status. 10 patients (76.9%) with improved Hb status showed improvement of heart failure class.

DISCUSSION:

CCHD in a true sense is a multisystem disease. Hematopoetic and hemostatic abnormalities are frequent and do have important clinical implication. Iron deficiency results in iron depleted, microspherocytic RBCs which are less deformable and more rigid. Blood viscosity increases despite the presence of lower hemoglobin concentration. Iron deficiency mimics or worsens hyperviscosity symptoms and known to be a strong risk factor for cerebrovascular events proven in adults.

Anemia is a global public health problem with reported prevalence of 65.5% in the preschool children in south east Asia as per WHO [5]. Iron deficiency is most common and in India, prevalence of IDA in children was estimated to be 70% in 1990 by Chakroborty. The picture has not much changed in recent times as per studies done.

In our study , TOF was most frequently found CCHD and male child comprised 67.7% of the study population. Thos is similar to the study done by Mukherjee S et al [6] where 74.5% children were diagnosed to have TOF and two third of them was male. Also, similar results was found by Amoozgar et al.[7] and Phujale S et al[8]. In our study; children between 1-3 yr of age group was largest (38.7%) with infants comprisisng 19.3% . This is in contrast to the finding of Mukherjee S et al. where study population was dominated by infants; but in accordance to Kapoor et al. where maximum number of cases were seen in 0-3 yr of age group. Probably as TOF and duct dependent lesions present a little later than at birth led to such finding.

48.4% of CCHD children were found to be anemic and 74.2% had MCV below 80. This data is comparable to Amoozgar et al. ; where 75.9% had anemia and 55.2% had MCV below 80. Similarly, 47.06% children had IDA in the study done by Mukherjee S et al.[6] The high prevalence of microcytosis in our patients was probably due to underlying iron deficiency which is a well proven fact.

Significant difference of Hb , PCV, MCV was present among anemic and nonanemic in our study. Anemics have significantly higher RDW than non anemics which probably reflects iron deficiency as the underlying cause of anemia.

64.5% patients presented with cyanotic spell, while 29% with cyanosis and 6.5% admitted with cerebral throbosis. This picture is in contrast with Gupta et al.,[9] where cyanosis with exertional dyspnoea was most frequent complain followed by cyanotic spell. This discrepancy may be due to the fact that this study had been conducted among hospitalised patients of a tertiary hospital, which might led to representation of more severely affected children of CCHD.

There is significantly higher association between cyanotic spell and anemia. 63.2% patient with cyanotic spell had anemia ($\chi 2$=4.288, df=1, p=0.038),which was similar to that of Mukherjee S et al.

Anemics had higher Modified Ross heart failure class than nonanemics. Also, patients with anemia had significantly prolonged hospital stay than nonanemics ($\chi 2$=4.812 df=1 p=0.028).

But, anemia was not significantly associated with PELOD score, Qp/Qs ratio and mortality rate; probably because of multifactorial etiopathogenesis other than anemia alone in patients with CCHD.

In the follow up after 3 months of oral iron therapy, 72% of anemics showed improvement in Hb status, Majority of patients with improved Hb status showed marked improvement in functional heart failure class; weight gain, and a substantial portion showed arrest in cardiac chamber enlargement.

LIMITATION:``

This study is limited by a small sample size and being a single centred, our findings cannot be extrapolated to general population of children with CCHD. Also, our exclusion criteria may have caused selection bias, leading to underestimation of prevalence and impact of anemia in CCHD. Furthermore, investigating proper etiology of anemia among the patients was beyond our scope.

CONCLUSION:

Notwithstanding the limitation, we have clearly showed a high prevalence of anemia among CCHD children and its impact on morbidity as higher incidence of cyanotic spell, prolonged hospital stay. Also, we have demonstrated improvement of weight, functional heart failure class, and to some extent arrest of chamber enlargement with intervention in a short term follow up.

So, this small study may light up importance of much more research on pediatric populaton to explore in greater details the incidence, distribution, detreminants and effect of anemia in CCHD.Also, physicians should look for anemia among children with CCHD and should treat aggresively which will lead to decrease in morbidity and may improve the quality of life of the little patients,

Table: Distribution of Hemoglobin, HCT, MCV and MCH in two group

	Anemic	Nonanemic	t test	p value	significance
Hemoglobin	12.79 ±.92	16.7 ±.90	-14.22	<.05	significant
HCT	38.90 ± 3.43	50.88 ±3.75	-11.11	<.05	significant
MCV	72.84 ±4.94	79.45 ±6.52	-3.86	<.05	significant
MCH	27.15 ±2.98	30.10 ±2.82	-3.37	<.05	significant

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