Childhood cyanotic congenital heart disease and iron deficiency

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ABSTRACT

Background: Inadequate tissue oxygenation results from cyanotic congenital heart disease. In an effort to increase red blood cell bulk, which will boost oxygen supply to the tissues, this in turn drives greater erythropoietin release from the kidneys. As a result of the prolonged erythropoiesis, polycythemia and frequently iron shortage arise from the depletion of iron reserves. Blood viscosity is enhanced and there is a propensity for bleeding thrombosis in both polycythemia and iron shortage.

Objective: To assess iron deficiency status in children with cyanotic congenital heart compared to normal healthy controls.

Method: At the Al-Zahra Teaching Hospital, a case control study was conducted from August 2017 to January 2018. 101 children were included in the study and divided into 51 cases and 50 controls. Serum ferritin levels, serum iron levels, serum hemoglobin levels, mean corpuscular volume, and TIBC were all measured and reported.

Results: There was highly significant difference between cases and control groups in regard to weight, height, hemoglobin level, hematocrit, MCV, serum iron, serum ferritin and TIBC.

Conclusion: Iron deficiency anemia is significantly documented in children with cyanotic congenital heart disease compared to control group.

Abbreviation: *CHD: congenital heart disease, MCV: mean corpuscular volume TIBC: total iron binding capacity, IDA: iron deficiency anemia*

Keywords: iron deficiency, iron deficiency anemia, cyanotic congenital heart diseases.

Introduction:

Congenital heart disease (CHD) in children is frequently associated with iron deficiency anemia (IDA) [1,2,3]. Since improper intracardiac communication typically results in low blood oxygen saturation in CHD patients, their endogenous and dietary iron stores are severely taxed, leading to relative iron deficiency anemia1. Cardiomyocytes need iron to produce mitochondrial energy, and its deficiency is related with unfavorable symptoms. [4] Cyanocobic episodes are more common when there is an iron deficiency [2], according to research. Hyperviscosity and its related consequences are also linked to iron deficiency. [2] Children with CHD are more

likely to have iron deficiency anemia, which can be brought on by a variety of different reasons. (3)

Aims of the study

To determine whether young children with cyanotic congenital heart disease—those under the age of five—have an iron shortage.

Patients and Method:

From August 2017 to January 2018, 6 months were spent conducting a case-control research. It included 51 children with cyanotic heart disease, confirmed by echocardiography (performed by the same pediatric cardiologist), who presented to the pediatric cardiac clinic at Al Zahra Teaching Hospital for Maternity and Children in Al Najaf city. The children ranged in age from 6 months to 5 years. These kids were compared to 50 healthy, typical kids of similar ages and sexes. The following are the inclusion requirements: 1. Kids between the ages of 6 months and 5 years. 2. Echocardiography confirms cyanotic heart defects. 3. Negative C - reactive protein (because the inflammation increases the serum ferritin). 4. PCV < 60%. Additional cardiac causes of cyanosis, when they are linked to other congenital deformities due to related syndromes, and when the infant is currently taking an iron supplement are also exclusion factors.

The weight of children was recorded with minimum clothes on and bared feet with Seca electronic scale (the same scale was used for each child). The height/length was measured with portable stadiometer with bare feet children.

Then 5m1 of venous blood was drawn from peripheral vein using a plastic 5 ml syringe from each child 2m1 of the sample was collected in a sterile labeled EDTA tube for complete blood count using DIAGON D-cell autohematology analyzer (Korea, 2013) and blood film which was read by the same hematologist. Then 1 ml of the sample collected gel tube for serum iron and TIBC these samples were centrifuged at 3000rpm for 10 minutes to 23 minutes. Obtain plasma, serum was separated in plain tube and measured by using BioLabo kit in spectrophotometer CECIL 1011. The last ml collected in plain tube for serum ferritin and after separation of the serum stored in freezer at -20 °C and then measured by using Vidas (biomeuirx- France, 2009). All mentioned investigations were done at Al Zahra hospital for maternity and childhood for all cases and controls.

Statistical analysis:

SPSS 17 was used for the analysis of the data. When the P value was 0.05, statistical significance was taken into account.

Results:

As shown in table 4, the results of the current study indicate that there were very significant differences between the case and control groups in terms of body mass index (BMI), height, hematocrit, MCV, serum iron, serum ferritin, and TIBC.

Table -4- Comparing cases and control groups

parameter	Control Mean+-SD	Case Mean+-SD	P-value
Weight (kg)	11.884 +- 2.9639	9.8 +- 3.22	0.001
Height(cm)	85.54 +- 11.930	83.29 +- 12.58	0.035
Hb (g/d1)	12.244 +- 1.1068	14.43 +- 1.106	0.000
Hct%	37.732 +- 3.3203	45.547 +- 5. 001	0.000
MCV(F1)	77.64 +-5.397	70.33 +- 7.350	0.000
MCH(pg)	29.140 +- 2.0604	27.798 +- 4.402	0.053
S.Iron	70.64 +- 8.616	52.47 +- 19.698	0.000
S.Ferritin(ng/d1)	13.75 +-3.006	11.37 +- 6.813	0.026
TIBC	322.58 +- 76.286	408.18 +- 120.2	0.000

Discussion:

Because patients with cyanotic CHDs had malnutrition, which resulted in nutritional deficiencies including iron, [5] the most important nutrient, which led to iron deficiency, which also caused a decrease in appetite and food intake and led to growth delay, there is a significant difference in weight, height, hemoglobin, hematocrit, MCV, serum iron, serum ferritin, and TIBC between the case and control groups in the current study (p-value 0.05). Even if a patient has a high hematocrit, the iron storage will be depleted, resulting in iron insufficiency, as we discovered in our study when the hematocrit increases, the serum ferritin decreases. In contrast to our findings regarding the MCV and MCH, which were both inversely related to serum ferritin while in our study there is a direct relation, this can be explained by the size of the study as they take much larger size than us. This is supported by the study of Lango et al. 2009[6] where there is inverse relation between the hematocrit and serum ferritin.

Conclusion:

Compared to controls, kids with cyanotic congenital heart disease had more pronounced iron deficiency anemia.

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