



# HEART MURMUR AND ANAEMIA IN THE PEDIATRIC POPULATION

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## ABSTRACT

Innocent heart murmurs are heart murmurs that occur in patients with a normal heart structure. They do not represent a disease of the heart and vascular system, and should not be treated as such. Iron-deficiency anaemia often causes, along with other symptoms, systolic heart murmurs and tachycardia. It appears in children of all ages representing a most common haematological paediatric disease. To establish the influence of iron-deficiency anaemia on genesis of innocent murmurs and to compare auscultatory and phonoelectrocardiographical findings in patients with anaemia and heart murmurs before and after iron therapy. The study includes 120 patients with innocent heart murmurs that have been auscultated at cardiorheumatic outpatient department of Pediatric Clinic of the Clinical Center of the University of Sarajevo, during the period from 01/01/2004 to 31/12/2004. Further diagnostic procedure, i.e. laboratory tests, diagnosed iron-deficiency anaemia in 30/120 patients. These patients have been followed in this study. 22/30 patients had systolic murmur I/II intensity of Levin scale; 8/30 patients had II/VI systolic murmurs of intensity by Levin. The highest number of examinees had 0-1 years of age, and in this group the number of boys was higher than the number of girls (M: F = 12:4). During the auscultatory and phono-ECG examinations of murmurs, 6 patients had haemoglobin values less than 95 g/l, which corresponds to an average and severe type of anaemia. 24 patients had haemoglobin values between 95 and 110 g/l, which corresponds to benign type of anaemia. The most numerous were patients aged between 0 – 1 year (3 patients with hemoglobin value Hb < 95 g/l, 13 patients with hemoglobin value Hb 95-110 g/l). All patients were treated with iron medicaments. After three months, clinical and laboratory re-evaluation was performed and it has demonstrated that after iron therapy 24 patients had level of a haemoglobin Hb > 110 g/l and 6 patients had haemoglobin levels between 95 and 110 g/l. By auscultatory and phono-ECG examinations, murmurs of a level of intensity I/II was registered in only one child, while in the other 29 patients there were not any registered heart murmurs. Diagnosis of anaemia in the paediatric population group delays definitive diagnosis of heart murmurs. Innocent murmurs in children with sideropenic anaemia occur as its consequence. After adequately conducted iron therapy, i.e. cured anaemia, heart murmurs were not auscultated.

**KEY WORDS:** innocent murmur, anaemia

## INTRODUCTION

The term “innocent heart murmur” defines heart murmur occurring in patients with a normal heart structure. This is the most appropriate term that can be understood by both child and parent. All functional murmurs appear in the conditions with high volume output, such as high temperature, anaemia, and excitement or during exercise. They are recognised by different acoustic and clinical features and can be distinguished from organic heart murmurs, which are caused by different heart and blood vessels illnesses. Patients with innocent murmurs do not have other clinical, x-ray or electrocardiographic abnormalities. They are shorter, lasts less than  $\frac{1}{2}$  systole, they contain vibratory (musical) component and are not transmittable. Innocent heart murmurs vary in respiration, they disappear during inspiration and they change in quality depending of the body position (1,2). The clinical importance of innocent heart murmurs lies in the fact that when unrecognised and wrongly interpreted, heart murmurs can unnecessarily trigger off a complicated and long diagnostic procedure that can put both parents and children in a state of fear from heart disease (2). Iron-deficiency anaemia often causes with other symptoms, systolic heart murmurs and tachycardia that are consequent of accelerated circulation and/or reduced blood viscosity. Other cardiological repercussions of iron-deficiency anaemia are accentuated first hearth sound on ic-tus, frequent and soft hearth rates. Iron-deficiency anaemia appears at children of all ages and represents a most common haematological paediatric disease (3). According to the World Health Organisation (WHO), a child has anaemia if it is concentration of haemoglobin (Hb) is:

- Hb < 110 g/L for children in the age between 0-1, except for children between 3<sup>rd</sup> and 6<sup>th</sup> month when anaemia is diagnosed if Hb < 105 g/L
- Hb < 110 g/L for children between the ages 2-5
- Hb < 120 g/L for children between the ages 6-12

For children older than 12 years anaemia is usually diagnosed if the concentration of haemoglobin is 130-135 g/L depending wheather it is male or a female child(3,4,5). The most frequent cause of iron deficiency in childhood is: a lack of iron depots in preterm newborns, low body mass in newborn infants, low iron supplies in food, feeding mostly with cow milk and flowery food, lack of meat in food, intensive haematopoiesis in the period between 6<sup>th</sup> and 9<sup>th</sup> month of life, that continues on “physiological anaemia“ when iron supplies in the body is reduced, difficulties in iron absorption, iron loss due

to intestinal haemorrhages, frequent infections, using fresh cow milk in the first months of life may cause occult intestinal haemorrhages and iron deficiencies (3,6).

## AIM

To establish the a correlation between iron-deficiency anaemia and genesis of innocent murmur as well as to compare auscultation and fono electrocardiograph findings in patients with anaemia and heart murmur before and after iron therapy.

## SUBJECTS AND METHODS

This study includes 120 patients with innocent heart murmurs that were auscultated at cardio-rheumatic outpatient department of the Paediatric Clinic of the Clinical Centre University of Sarajevo, during the period from 01/01/2004 to 31/12/2004. Further diagnostic procedures, i.e. laboratory tests, diagnosed iron-deficiency anaemia in 30 patients. This group of patients was followed during prospective, clinical-analytical study in period since diagnosing iron-deficiency anaemia and heart murmur, through therapeutic procedures until clinical, laboratory and phono electrocardiograph reevaluation. In this paper we used clinical examinations, laboratory tests and a questionnaire to explore risk factors for anaemia and nutrition habits.

## RESULTS

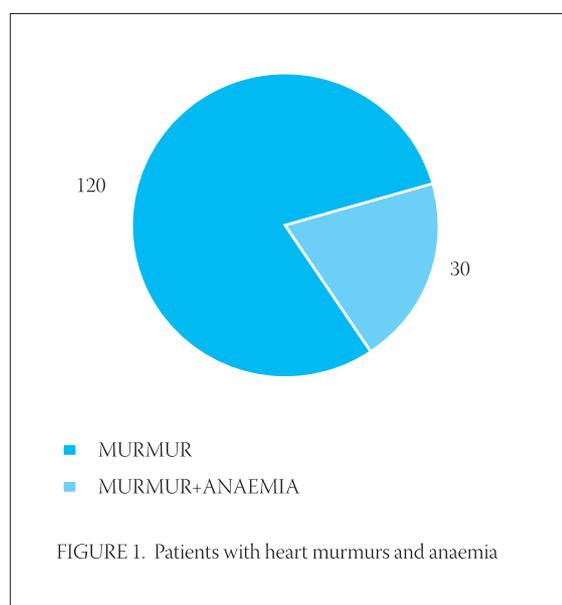


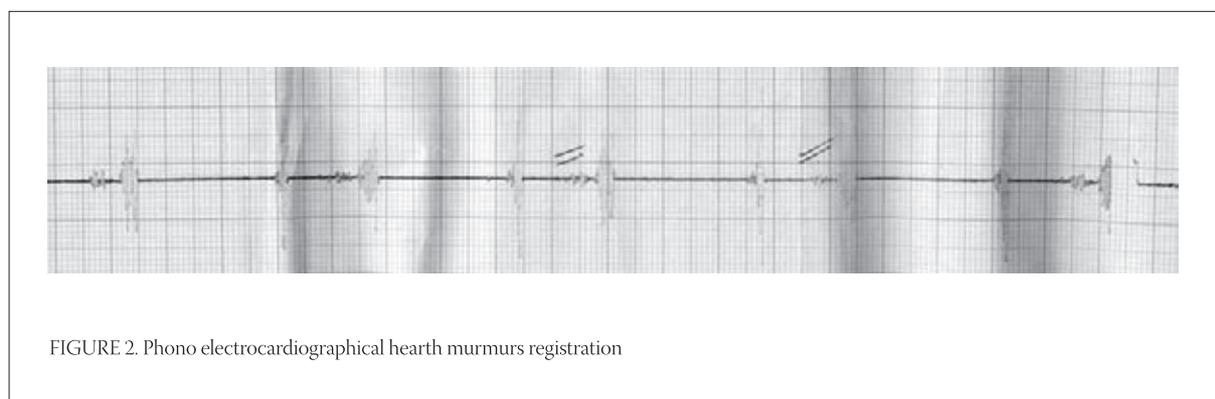
FIGURE 1. Patients with heart murmurs and anaemia

SEX	AGE			
	0-1 years	2-6 years	7-11 years	12-16 years
MALE	12	3	2	1
FEMALE	4	4	3	5

TABLE 1. Sex and age of patients

Degree of hearth murmur	Number of patients
I	/
I/ II	22
II	8

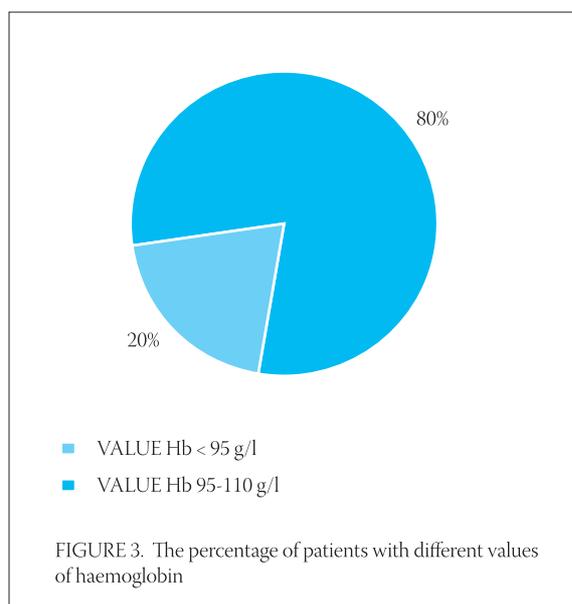
TABLE 1. Sex and age of patients



Values of haemoglobin in-patients during auscultation examination of systolic murmur, prior to the start of therapy, are shown in Table 3.

VALUE Hb	Hb<95 g/l	Hb 95-110 g/l
NUMBER OF PATIENTS	6	24

TABLE 3. Values of haemoglobin before iron therapy



Out of 30 patients with auscultatory findings of systolic murmur, five had haemoglobin value below 95 g/l, which corresponds to an average and severe type of anaemia, 22 patients had value of haemoglobin between 95 and 110 g/l which corresponds to a benign type of anaemia and 2 patients did not have anaemia, i.e. their haemoglobin values exceeded 110 g/l.

Age structure of patients by types of anaemia is shown on Tables 4 and 5.

Hb <95 g/l

AGE	0-1 year	2-6 years	7-11 years	12-16 years
NUMBER OF PATIENTS	2	1	2	1

TABLE 4. Age structure of patients with values Hb<95g/L

Hb 95-110 g/l

AGE	0-1 year	2-6 years	7-11 years	12-16 years
NUMBER OF PATIENTS	12	6	3	5

TABLE 5. Age structure of patients with values Hb 95-110g/l

TERM INFANT	YES	10
	NO(before)	7
CHILD BORN WITH LOW BIRTH WEIGHT	YES	6
	NO	11
CHILD BORN FROM TWIN-PREGNANCY	YES	0
	NO	17
CHILD BREAST FED BY 6 <sup>th</sup> MONTH OF AGE	YES	1
	NO	16
CHILD BREAST FED BY 1 <sup>st</sup> YEAR OF AGE	YES	2
	NO	15
CHILD FED WITH COW-MILK SINCE THE BIRTH	YES	7
	NO	10
CHILD FED WITH ADAPTED MILK FORMULA SINCE BIRTH	YES	7
	NO	10

TABLE 6. Risk factors for pathogenesis of iron-deficiency anaemia in children aged 0 – 2 years

FOOD	CONSUMPTION ON DAILY BASIS	CONSUMPTION THREE TIMES PER WEEK	CONSUMPTION ONCE PER WEEK	CONSUMPTION ONCE A MONTH
EGGS	20	3		
BEEF LIVER		3	7	13
BEEF MEAT		8	10	5
BEANS		11	8	4
DRIED FRUITS		2	3	18
PASTA	10	10	3	
POTATO	15	8		

TABLE 7. Nutritional habits of patients

## THERAPY:

- Medicaments of trivalent iron in daily dosage of 3 mg/kg of body weight split in three doses.
- C vitamin according to body weight of the patient.

VALUE Hb	Hb<95 g/l	Hb 95-110 g/l	Hb>110 g/l
NUMBER OF CHILDREN	0	6	24

TABLE 8. Values of Hb after iron therapy

AUSCULTATORY RESULT OF SYSTOLIC HEART MURMUR	
PRIOR TO IRON THERAPY	AFTER IRON THERAPY
n=30	n=1

TABLE 9. Auscultatory results of systolic heart murmur after iron therapy

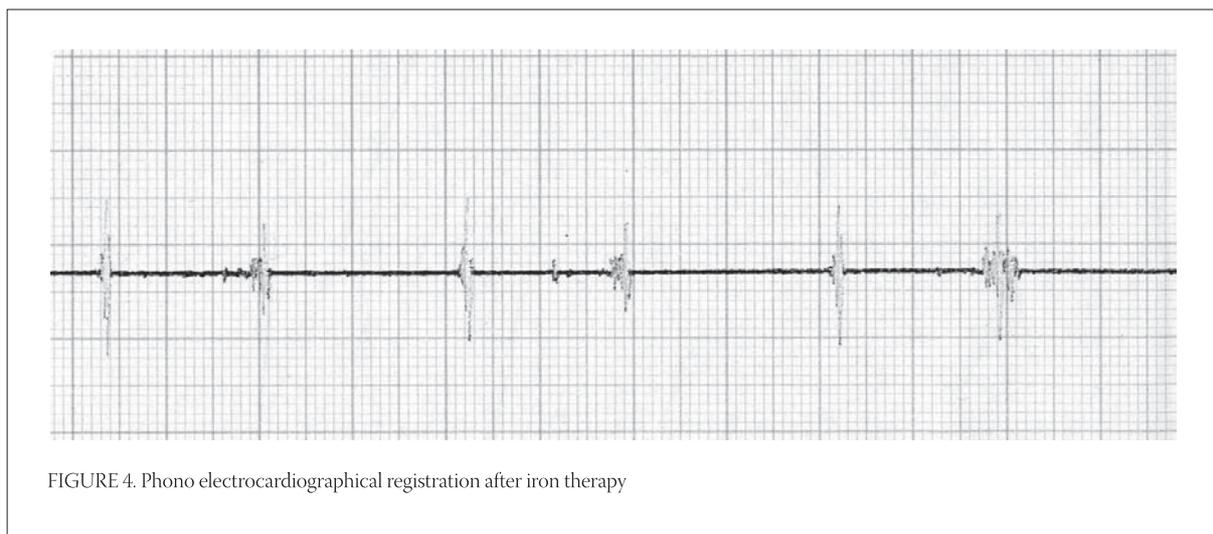


FIGURE 4. Phono electrocardiographical registration after iron therapy

## DISCUSSION

The most frequent murmurs in childhood are the ones, which are not caused by anatomic abnormalities of the heart. They are called: “innocent”, “benign”, “functional”, “physiological”, and “non-pathological”, “vibratory”. First description of such murmur was given by Still, around 70 years ago. (7) The Still’s murmur could be best heard alongside the left sternum edge and towards apex of the heart. Innocent murmurs vary when the position of the body is changed; its intensity decreases or disappears if patient is in standing position and reverses if the patient changes position of it’s body. This is being brought into connection with an increase of velocity of blood pumped out the left ventricle (8), or an anomalous tendons chordae of the left ventricle (9) as well as by an increase of normal vibratory activity during ventricular contraction (10) The second type of innocent ejection murmur is caused by increased blood velocity. It is audible in the second intercostal space on the left, seldom on the right side. This type of murmur is audible in children with deformed thorax – pectus excavatum (11). High heart ejection is combined with high body temperature, anaemia, thyrotoxicosis, fear and these con-

ditions intensify these murmurs. Final evaluation of the innocent murmurs should be delayed by the time the patient is reversed to the initial hemo-dynamic status. Exact diagnosis of suspected innocent murmurs require evaluation of the cardio-vascular status performed by a cardiologist. Diagnosis of innocent (functional) murmurs comforts patient’s parents and the physician who sent the child to the cardiologist. Detailed history with physical examination distinct findings of innocent murmur from murmurs caused by structural abnormalities (12). It is very important that the family doctor / paediatrician, in case of suspected innocent murmurs, perform an examination of the cardio-vascular system with detailed history, by respecting all algorithms of evaluation with the aim of either confirming or excluding organic findings of the heart. Definitive diagnosis is to be given by the paediatrician – cardiologist. Innocent heart murmurs do not represent diseases of heart and vascular system, and it should not be treated as such. In childhood, over 80% of children at the age of three or four have a functional type of murmur (1). In our study 30/120 patients have been diagnosed with sideropenic anaemia. This group of patients was followed during research. The ECG’s and the X-ray’s were normal in all of the patients. We have established aus-

cultatory and by phono-electrocardiogram that 22 patients had systolic murmur of an intensity level I/II, and 8 patients had systolic murmur of an intensity level II (by Levin). The highest number of examinees were 0-1 years of age, and in this group the number of boys was higher than number of girls (male/female ration= 12:4). During the auscultatory and phono-ECG findings, 6 patients had haemoglobin value less than 95 g/l that corresponds to an average and severe type of anaemia. 24 patients had haemoglobin values between 95 and 110 g/l, which corresponds to a benign type of anaemia. The majority of patients were aged between 0 – 1 year (3 patients with haemoglobin value Hb < 95 g/l, 13 patients with haemoglobin value Hb 95 -110 g/l). According to Mardesić and co-workers (13), the highest incidence of anaemia caused by iron deficiency was recorded in older infants, in the first and second year of life. Recent studies have show that 10% of healthy, term infants from different parts of Europe have levels of haemoglobin Hb<110 g/l. According to data from Scandinavian countries, 5% of Danish infants 9 months old and 10% of Norwegian children aged from 0 – 2 years have anaemia due to iron deficiency (3,7) Data on this issue from the area of Bosnia and Herzegovina show that the percentage of anaemic children is increasing and is higher than before the aggression on Bosnia and Herzegovina, which is often being brought into connection with the poor social-economical situation. The most important factor, which affects the occurrence of anaemia due to iron deficiency, is nutrition. We have conducted research of nutrition habits in our 30 patients. The following results within the group of children aged 0 – 2 years (n=17) are:

- 2 children were breast-fed by their first year
- 1 child was breast fed till the six month of life
- 7 children were fed by cow milk since birth
- 7 children were fed by adapted milk formula since birth

Gil and co-workers (14) show incomparably better status of iron in children fed by milk formula, comparing to children fed by cow milk. Negative sides of cow milk given to infants are low iron concentration, weak absorption and micro-occult bleeding in the gastro-intestinal tract (GIT). All of the afore mentioned confirms the well-known fact that anaemia due to iron deficiency seldom occurs in children fed by natural nutrition. For children aged between 2 and 16 years, we have examined nutritional habits, i.e. ratio of iron rich foods in nutrition; the most frequent are powdery foods derived

from foods of animal origin, that represents a risk for the occurrence of anaemia. However, the fact that should be taken into consideration is that the pool has been conducted within a small group. All children were treated by iron medicaments according to the following scheme:

- medicaments of trivalent iron, daily dosage of 3 mg/kg/day split into three individual doses between meals together with vitamin C,
- solutions are to be given to infants. Syrup or drops are to be given to little children,
- recommended nutrition: breast feeding in the first six months, after 6th month introduction of iron rich foods,
- different iron rich foods are recommended for children over 2 years of age.

Therapy usually lasted approximately 3 months depending on clinical status of the child and blood status that was controlled once a month. Checks on the regularity of therapy and possible negative effects of the same, have been conducted with parent / tutor of the examinees on a three-week basis. After three months, clinical and laboratory re-evaluation was performed and it has demonstrated that after iron therapy 24 patients had level of haemoglobin Hb >110 g/l and 6 patients had haemoglobin a levels between 95 and 110 g/l. By auscultatory and phono-ECG examinations, murmurs of a level of intensity I/II were registered in only one child, while in the other 29 patients there were not any registered hearth murmurs.

## CONCLUSION

Heart murmur in the paediatric population require detailed evaluation of the history and physical/auscultatory findings having in mind the hemodynamic status of the patients at the moment of examination.

It is necessary to obtain an expert opinion from a paediatrician – cardiologist on the cardiac status of the patient with functional (innocent) murmurs, which comforts parents, the child and the physician who sent the patient for re-evaluation as well as avoiding additional diagnostic tests

Diagnosis of anaemia in the paediatric population group delays definitive diagnosis of heart murmurs.

Innocent murmurs in children with sideropenic anaemia occur as its consequence.

After adequately conducted iron therapy, i.e. cured anaemia, heart murmurs were not detected.

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