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The Role of Doppler Imaging in the Evaluation of Immunological Complications in Thalassemia Patients' Children

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Abstract: This study aims to know the role of Doppler imaging in the evaluation of immunological complications in Thalassemia patients' children with a study period Full time (one year from 22-9-2019 to 1-10-2020). In this study, 200 patients were collected and distributed into two groups (patients 120) (control group 80), and demographic information and data were collected through cooperation with different hospitals in Iraq, where included children between the ages of 5-16 years. Has been determined Conventional echocardiographic as one of the immunological manifestations which have been studied to know the effects of thalassemia on children. The results indicated a significant increase in systolic myocardial velocity for thalassemia patients with mean± sd 11.1+1.44, while for the control group 7.44+1.45of the septal wall of the basal mitral annulus myocardial velocities there were statistical differences between the two groups, with a statistical significance p value < 0.001.The cognitive functions of the heart were evaluated in this study as one of the immune diseases, and it was noted that there was slight disturbances in the functioning of diastolic myocardial velocity to the thalassemia patients compared with the control group, and the statistical analysis showed a weak direct relationship in this study. Issue Doppler imaging provides distinct and early results for conventional echocardiography to thalassemia patients, and a direct relationship was found between patients and those with a global disease condition.

Keywords: annulus, Doppler imaging, Thalassemia, patients, relationship, echocardiography.

INTRODUCTION

Thalassemia in children is a blood disorder inherited from the father or the mother or both that occurs in the red blood cells [Sinniah, D. *et al*., 1981], which are the blood cells responsible for transporting oxygen throughout the body, and they do this along with a red blood cell protein called hemoglobin. [Weiss, G. *et al*., 2002].

Therefore, it is a non-contagious disease, but it is hereditary and transmitted from parents to children. In fact, about 7% of the world's population is carriers of hemoglobinuria, and each year between 300,000 and 13.5 million children are born with severe homozygous hemoglobinopathy, according to data from the Spanish Society of Pediatric Hematology and Oncology (SEHOP). [Ghaffari, J. *et al*., 2008; Kyriakou, D. *et al*., 2001; Amer, J. *et al*., 2005]

However, thalassemia is one of the most common genetic disorders worldwide, in which hemoglobin is partially or completely suppressed as a result of a defect in the synthesis of one or more globin chains. According to the data of the World Health Organization, every year, around 300,000 children are born with thalassemia syndrome (30%) in the world [Walter, P.B. *et al*., 2013; Kalaczkowska, E. *et al*., 2013; Del Rio, L. *et al*., 2001; Ampel, N.M. *et al*., 1989; Ren, B. *et al*., 2004].

It is known that anemia in sickle cell disease is well tolerated by the cardiovascular system for a long time [Mantovani, A. *et al*., 2011], but over the years, the heart function is affected, and a variety of symptoms and signs appear similar to those of ventricular malformations, valvular dysfunction and myocardial ischemia [Amulic, B. *et al*., 2012]. Demonstrating that cardiovascular dysfunction is common in this disease and often goes unnoticed, it was therefore determined that cardiovascular damage was previously the result of chronic anemia and a compensatory increase in cardiac output [Reeves, E.P. *et al*., 2002; Fujita, N. *et al*., 2007]. This chronic overload leads to a compensatory response, and mainly cardiac hypertrophy is seen, although dilation and hypertrophy of the left cavities occur more frequently [Li, C.K. *et al*., 2002]. The systolic and diastolic functioning of the left ventricle at rest is usually normal. In patients with these changes, lower peripheral vascular resistance maintains normal left ventricular systolic function [Ardalan, F.A. *et al*., 2004]

It is indicated that in children with basal hemoglobin levels in the range of 60-80 g/dL, cardiac output at rest rises to 50% in order to supply the tissues' oxygen needs. This increase is achieved as the volume of minutes increases,

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resulting in hyperdynamic circulation, [Cunningham, M.J. *et al*., 2004] murmurs, and cardiac hypertrophy. Heart failure is rare, but the shortness of breath, palpitations, and fatigue are caused by anemia rather than heart failure, the latter occurring when there is a sudden drop in haemoglobin. [Prati, D. *et al*., 2004] Right ventricular hypertrophy is less common and usually occurs in patients with pulmonary hypertension. 50% of adolescents exposed to exercise stress have ST-segment depression due to subendocardial ischemia. [Perifanis, V. *et al*., 2005; Di Marco, V. *et al*., 1997]

In a 2011 study by Ken Arnhem, the study showed that heart failure caused by an excess of iron in the blood is one of the main causes of fatality in patients with thalassemia B, and echocardiography is a non-invasive tool that plays a major role in the detection of cardiovascular disease. [Angelucci, E. *et al*., 2002; Di Marco, V. *et al*., 1992]

The study confirmed that the patient with Thalassemia B had a significant increase in the values of the diastolic and systolic ventricular diameter index compared with the healthy ones; on the other hand, there were no differences in the cardiac ejection rate and the systolic index, and the advanced cardiac tissue Doppler imaging TDI [Donohue, S.M. *et al*., 1993; Syriopoulou, V. *et al*., 2005; Giardini, C. *et al*., 1997].

MATERIAL AND METHOD

Patient's Sample

In this study, 200 patients were collected and distributed into two groups (patients 120) (control group 80), and demographic information and data were collected through cooperation with different hospitals in Iraq, where included children between the ages of 5-16 years.

Study Design

In this study, children between the ages of 5-16 years were included, where the primary demographic information related to (weightage - gender) was collected, and it was also adopted in the assessment of immunological complications in Thalassemia patients' children on Tissue Doppler.

Has been determined Conventional echocardiographic as one of the immunological manifestations which have been studied to know the effects of thalassemia on children.

Currently, tissue Doppler is used primarily as a clinical research tool. However, TDI technology and equipment are also used in echocardiography. TD has proven useful in identifying systolic and diastolic functions or dysfunctions of the left ventricle.

Tissue Doppler imaging is a Doppler mode designed in clinical practice specifically to assess the speed of movement of tissues themselves and tissue fluids. Currently, TD is used to study the movement of the heart muscle and the walls of blood vessels.

The speed of movement of these tissues is low, in contrast to the amplitude of the signal reflected from the tissues. In other words, the molecules in the tissues reflect a sufficient amount of ultrasound (a strong reflector), but they move relatively slowly. Blood, for example, moves at a much higher speed, but the amplitude of the signal reflected from its cells is very small, so different patterns are used for their studies.

Study Period

Full-time (one year from 22-9-2019 to 1-10-2020).

AIM OF STUDY

This study aims to know the role of Doppler imaging in the evaluation of immunological complications in Thalassemia patients' children.

RESULTS

Table 1: Distribution of patients according to Age

V	Frequency n=120	P %	Chi-square
5-8	50	41.6	
9-12	40	33.3	22.3
13-16	30	25.03	

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Table 2: Distribution of group control according to age

V	Frequency n=80	P %	Chi-square
5-8	40	50%	
9-12	20	25	14.5
13-16	20	25	

Table 3: Distribution of patient and control group according to sex

	Male	Female	P-value
Patient n=120	66	54	0.87
Control n=80	44	36	0.88

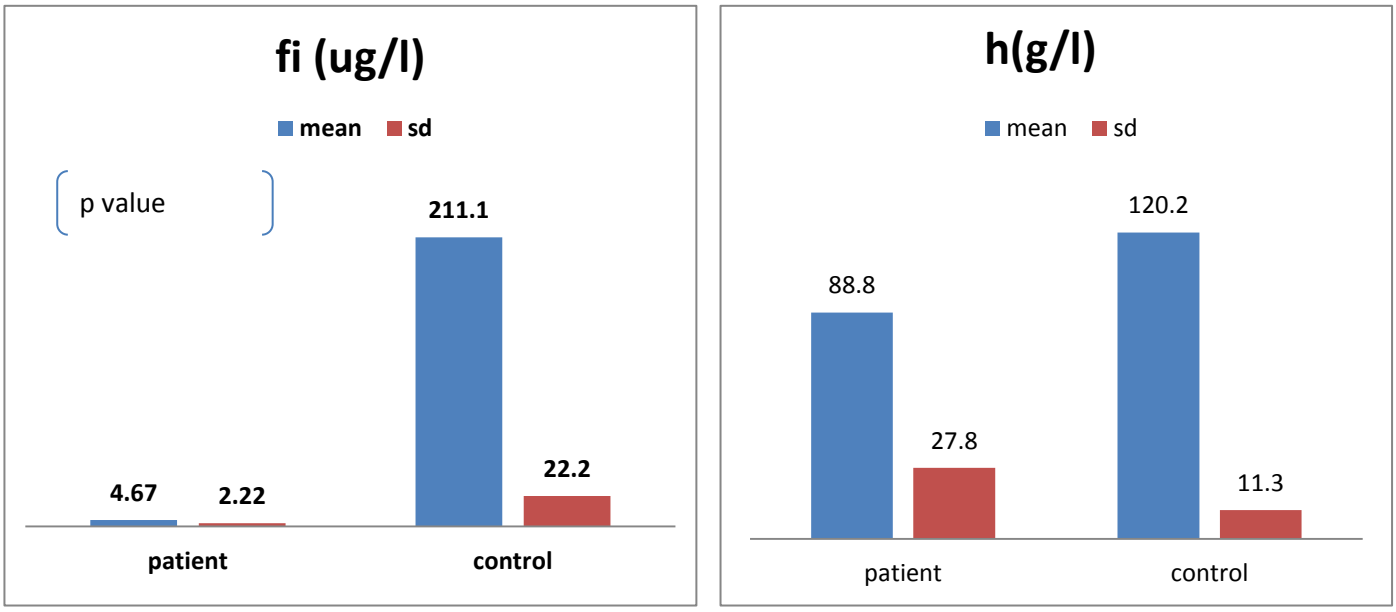

Figure 1 a: Demographic results of ferritin, 1B demographic results Haemoglobin (g/L)

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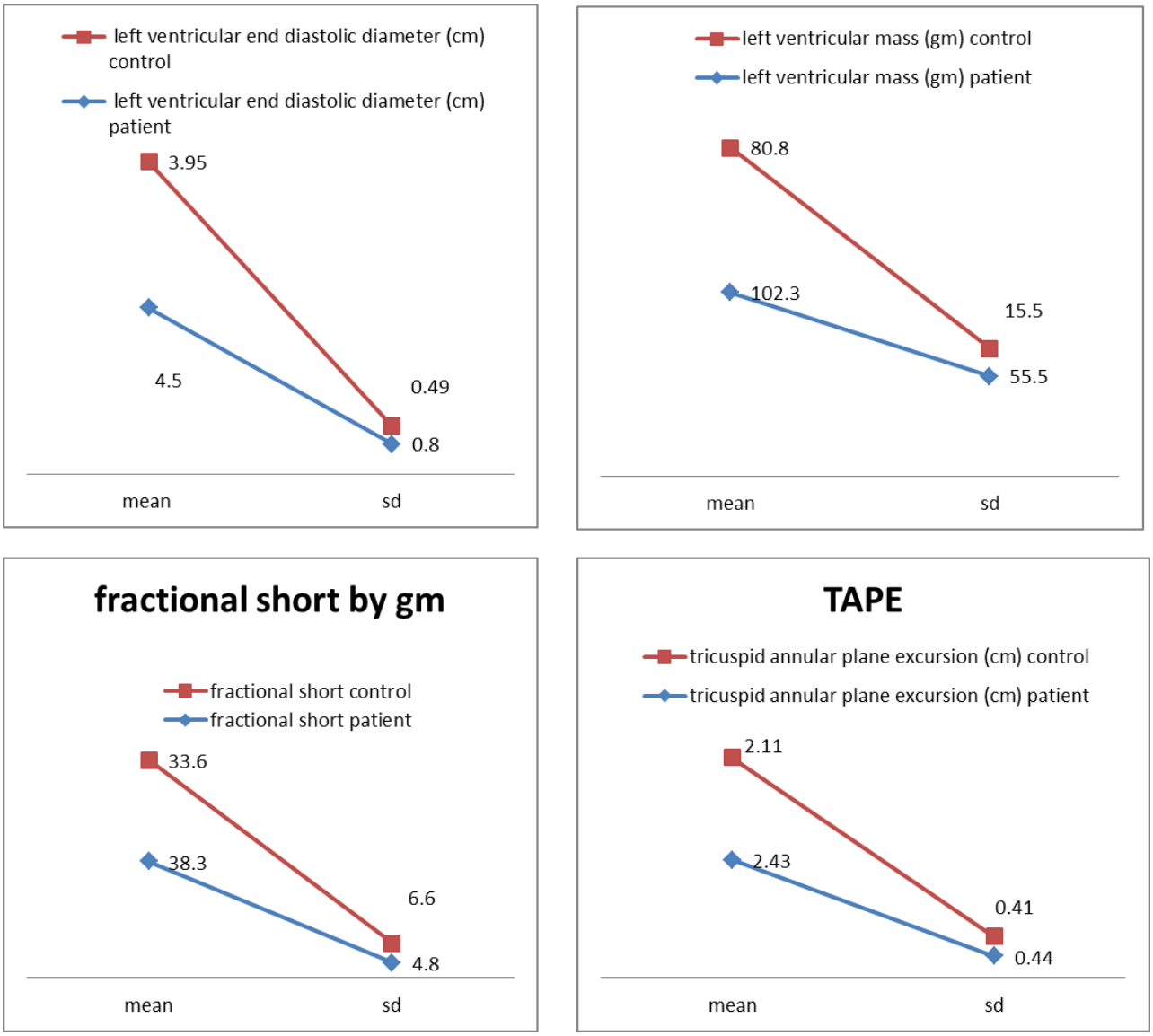

Figure 2: Outcomes of study related on echocardiographic

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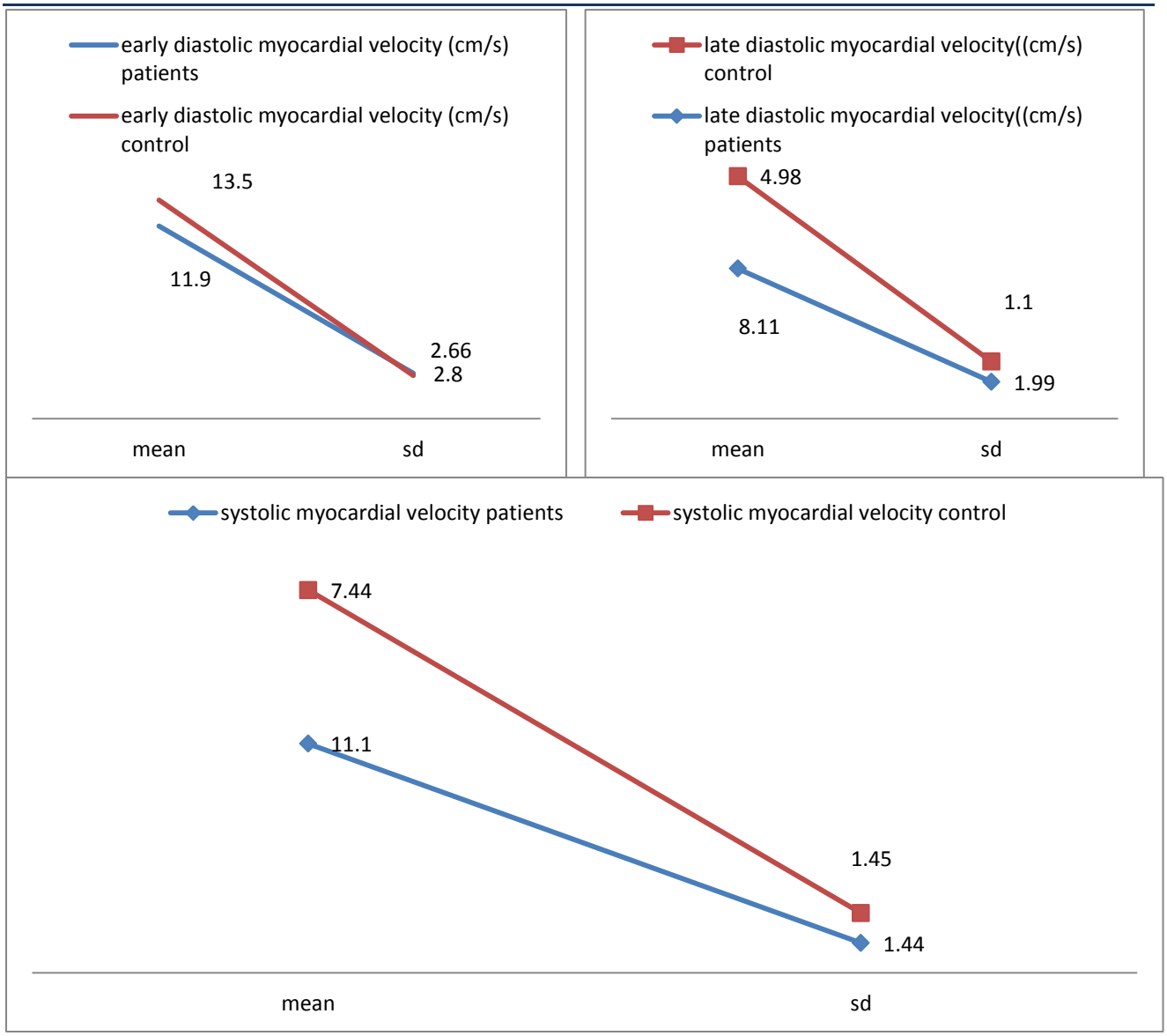

Figure 3: Immunological complications in Thalassemia patients' children Mitral valve, septal wall

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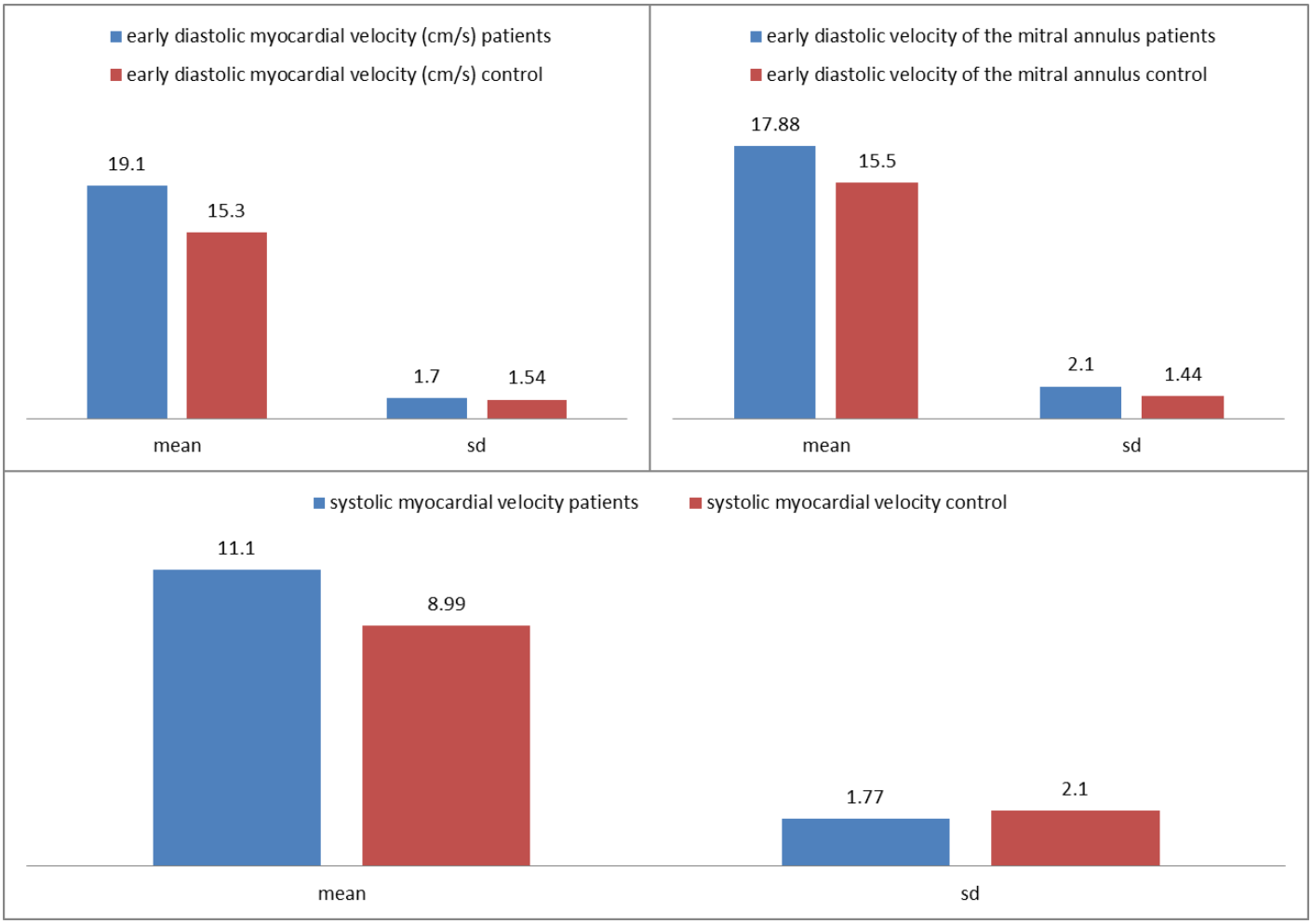

Figure 4: Immunological complications in Thalassemia patients' children (lateral wall)

DISCUSSION

In this study, 200 children were collected and distributed into two groups (120 children as a control group) (and 80 children as a control group). Patients were distributed according to age for 120 patients from 5-8 to 50 patients with 41.6%, from 9-12 years old, 40 patients with 33.3%, from 13-16 years old, 30 patients with 25.03 percent, and chi-square was to the thalassemia patients for 22.3 as shown in Table 1.

In Table 2, the control group was distributed according to age. The most frequent ages were 5-8 years for 40 patients with 50%, followed by 9-12 years for 20 patients with 25%, and 13-16 years for 20 patients with 25%. The chi-square of 14.5 was lower compared to the patient's group.

Patients were distributed according to gender. In the patient group, males were more prevalent for 66 boys, while girls were somewhat less prevalent for 54 patients.

As for the control group, the prevalence of boys was 44 and the girl 36, as shown in Table 3.

haemoglobin levels were measured at a low level in a group of patients, and this shows the effect of thalassemia.

Thalassemia is caused by a genetic mutation in the DNA of the haemoglobin-forming cells. This mutation is genetically transmitted from parents to offspring. The occurrence of genetic mutations disrupts the production of normal haemoglobin, and therefore the low levels of haemoglobin and the high rate of red blood cell damage (which happens in patients with thalassemia) leads to the emergence of symptoms of anemia.

It is described as a low level of haemoglobin and a decrease in the number of red blood cells below the normal rate. The reason for the appearance of symptoms of anemia, such as stress, fatigue, and others, is due to the lack of haemoglobin, the substance in red blood cells responsible for carrying oxygen.

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Ferritin deficiency also has negative effects on children and adults, including fatigue and poor physical performance, as well as its impact on social activities. Ferritin deficiency mainly occurs when the body's iron needs increase during periods of rapid growth, such as in early childhood and adolescence.

In this study, a week was used to detect heart diseases for children between the ages of five to 16 years. In this study, those with thalassemia were used.

Left ventricular end-diastolic diameter to the control group at 3.95± 0.94 cm, and in the patient group, it was Mean ± Sd. A significant height was observed with a mean ± sd 4.5± 0.8.

The same is the case for the left ventricular mass, where found a higher value at 102 ± 55.5, while for the control group, it was mean ±sd at 80.8 ± 15.5.

The cognitive functions of the heart were evaluated in this study as one of the immune diseases, and it was noted that there were slight disturbances in the functioning of the functions in early diastolic myocardial velocity to the thalassemia patients compared with the control group and the statistical analysis showed a weak direct relationship in this study.

Myocardial velocities there were statistical differences between the two groups, with a statistical significance p value < 0.001.

Where the results indicated a significant increase in systolic myocardial velocity for thalassemia patients with mean± sd 11.1+1.44, while for the control group, 7.44+1.45.

CONCLUSION

In this study, we conclude that the use of tissue Doppler imaging provides distinct and reel results for conventional echocardiography to thalassemia patients, and a direct relationship was found between the group of patients and the comparison group at a p-value of 0.01.

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