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EJECTION FRACTION AND LEFT VENTICULAR FUNCTION IN NON-HYPERTENSIVE OBESE CHILDREN: A CROSS SECTIONAL STUDY

[1]Dr Hafiza Tarum Naveed, [2]Dr Romana Arif, [3]Dr Muhammad Imran
[1]DHQ Hospital Sargodha
[2]Allied / DHQ Hospital Faisalabad
[3]Shaikh Zayed Hospital Raheem Yar Khan

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Abstract:
Objective: *The aim of this study was to assessed cardiac functioning through standard Pulsed Wave Doppler and Tissue Doppler Imaging echocardiography in obese adolescents*
Materials and Methods: *We investigated systolic and diastolic dysfunction with the help of cross-sectional research and echocardiographic modalities. Our research included BMI>30 and healthy children including 25 in each group and divided into BMI cases and control healthy groups. A complete CVD assessment, echocardiography and electrocardiography was carried out in every patient. Pulsed Wave Doppler and Tissue Doppler Imaging (TDI) was used in the echocardiography surveys. Data analysis and entry was carried out in the SPSS – 24.*
Results: *Age and sex were matched in both the research groups and high rate of the blood pressure and resting heart was observed in the obese group with a significant p-value as (0.0001) with normal range with similar function of ejection in both the groups. Left ventricular mass (LVM), end diastolic diameter, mass index LV, diameter ratio of atrial to aortic and end diastolic LV diameter were having respectively significant p-values of 0.0001, 0.029, 0.0001 and 0.008. The higher significance presented a dysfunction of diastolic, systolic and cardiomegaly. Diastolic dysfunction can be observed through low variables in case groups except aortic. There was a significant variation in the both categories parameters. We also observed a correlation between BMI and is volumetric relaxation time.*
Conclusions: *There is a relation between the without hypertension obese children and subclinical systolic & diastolic dysfunction. The blood pressure evaluation is proposed including myocardial performance with the help of TDI and PWD in the target population of without hypertension obese children.*
Keywords: *End Diastolic Diameter, Doppler, Left Ventricular Mass, Pediatric Obesity, Echocardiography.*

Corresponding author:
Dr. Hafiza Tarum Naveed,
DHQ Hospital Sargodha.

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INTRODUCTION:

Obesity prevalence is at increase over the world. This also includes the challenge of obese children without the incidence of hypertension and obesity is also well-established in the adult population; whereas, there are no reports of cardiac dysfunction in the obese children. Investigations about the clinical variables in the children who are obese are helpful in the forthcoming issues diagnosis and may also diagnose few of the contributing factors of obesity [1]. High risk children may also be attributed to the new methods such as prophylaxis of CVD sequelae in higher categories of risk. Cardiac function can possibly be depressed through the absence of hypertension. Cardiac dysfunction is also attributed to the increased BMI and its severity [2]. Our research assessed cardiac functioning through standard PWD and TDI echocardiography in obese adolescents.

MATERIALS AND METHODS:

This study was carried out at DHQ Hospital Sargodha and the duration of this study was from January 2019 to February 2020. We included BMI>30 and healthy children including 25 in each group and divided into case BMI cases and control healthy groups. A complete CVD assessment, echocardiography and electrocardiography was carried out in every patient 5 – 15 years of age. Both groups were matched for gender and age. BMI formula was used for the BMI calculation (BMI = weight kg / height m^2. Parents were asked to submit written consent. Firstly, for one-minute heart rate was observed, right arm blood pressure (BP) thrice for 20 minutes. Hypertension was considered as BP > percentile of 95. Laboratory investigations about blood CP, LFT, blood sugar fasting, serum insulin fasting, function test of thyroid and assessment of homeostatic model about insulin resistance [3]. Insulin and blood glucose were measured at the interval of twelve hours of fasting. HOMA‑IR was measured through the formula HOMA‑IR = insulin fasting mIU / mL × blood glucose fasting mmol / L / 22.5. Chest X-Ray, echocardiography and electrocardiography was also carried out in all the patients. All the obese children with 90 percentiles above diastolic or systolic BP, BMI < 30 & > 25, thyroid disorders, sleep apnea, an abnormal blood lipid profile, decreased ejection fraction, cardiac structural irregularities, anti-obesity drugs intake and systemic diseases were not included in this research.

To evaluate systolic and diastolic heart function echocardiography was carried out. Statistical analysis was carried out in SPSS – 24. Mean and SD were also calculated, sex distribution was carried out in Chi-Square test, age was compared through student T-test and Pearson's linear correlation coefficient analysis was also carried out for the assessment of the BMI relation to other parameters and echocardiography. Significant p-value was observed as (0.05).

RESULTS:

Age and sex were matched in both the research groups and high rate of the blood pressure and resting heart was observed in the obese group with a significant p-value as 0.0001 with normal range with similar function of ejection in both the groups. Left ventricular mass (LVM), end diastolic diameter, mass index LV, diameter ratio of atrial to aortic and end diastolic LV diameter were having respectively significant p-values of 0.0001, 0.029, 0.0001 and 0.008. The higher significance presented a dysfunction of diastolic, systolic and cardiomegaly. Diastolic dysfunction can be observed through low variables in case groups except aortic. There was a significant variation in the both categories parameters. We also observed a correlation between BMI and isovolumetric relaxation time. Case and controls are compares in Table-I. The research included 25 obese and 25 normal children respectively with having males as 64% and 56% with the mean age factor of 10.41 ± 3.52 and 9.92 ± 3.51 years. Every group was also observed with an in-range BP. Standard echocardiography observed an increase in the LV and cardiomegaly in the obese children without hypertension. Table-III lists the parameters of PWD echocardiography. No difference was observed in controls and cases with significant p-value as (0.560). Significant low values of E, A and E/A waves were observed respectively as 0.0001, 0.020 and 0.009. In the non-hypertensive cases an incidence of diastolic dysfunction was present. Table-IV presents the parameters of TDI echocardiography. Varying parameters were significant about S‑VTI in both the groups as p-value (0.25). Significant differences were present in the ratios of Am, Em, Sm, DI, IVRT, E/Em and L0in controls and cases. It is concluded that without hypertension, there is a significant reduction in the function of LV systolic which is an impairment of the motion of the longitudinal myocardial and an increase in the diastolic dysfunction arises because of the compliance and cardiac relaxation impairment.

Table 1: Comparison of The Clinical Characteristics in The Case and Control Groups

Details	Case group	Control group	*P-value*
BMI (kg/m^2)	33 ± 1.75	18.68 ± 2048	0.0001
Male/female (%)	0.64 / 0.36	0.56 / 0.44	0.564
HR (bpm)	89.20 ± 7.44	82.24 ± 6.62	0.0001
SBP (mmHg)	130.40 ± 6.60	119.16 ± 7.08	0.0001
DBP (mmHg)	84 ± 6.29	74.52 ± 5.12	0.0001
Age	10.41 ± 3.52	9.92 ± 3.51	0.62

Table 2: Comparison of Standard Echocardiographic Parameters Between the Two Groups

Details	Case group	Control group	*P-value*
EF (%)	69.10 ± 2.16	69.64 ± 2.12	0.381
LA/AO ratio	1.39 ± 0.08	1.21 ± 0.07	0.0001
LVM (g)	225.84 ± 30.52	113.40 ± 17.90	0.0001
LVMI (g/m^2)	6.88 ± 0.99	6.17 ± 1.24	0.029
LVEDD (mm)	44.4 ± 2.4	41.9 ± 3.8	0.008

Table 3: Comparison of Pulsed Wave Doppler Parameters in The Two Groups

Detail	Case group	Control group	*P-value*
A (cm/s)	84.44 ± 9.32	95.84 ± 21.27	0.02
E (cm/s)	165.04 ± 12.82	188.12 ± 15.50	0.0001
E/A	1.61 ± 0.22	1.99 ± 0.65	0.009
Aortic velocity (m/s)	1.21 ± 1.04	1.09 ± 0.09	0.56

Table 4: Comparison of The Tissue Doppler Image Parameters in The Two Groups

Details	Case group	Control group	*P-value*
Sm (cm/s)	9.86 ± 0.59	10.82 ± 1.21	0.001
Em (cm/s)	18.28 ± 0.75	16.30 ± 1.66	0.0001
Am (cm/s)	6.98 ± 0.43	10.01 ± 1.09	0.0001
Em/Am	2.63 ± 0.241	1.64 ± 0.174	0.0001
E/Em	5.42 ± 0.43	6.28 ± 0.62	0.0001
IVRT (ms)	77.94 ± 6.61	58.08 ± 12.15	0.0001
DI (%)	0.35 ± 0.04	0.31 ± 0.05	0.002
S-VTI (cm)	1.85 ± 0.12	1.80 ± 0.21	0.25
L_0 (cm)	5.38 ± 0.63	5.95 ± 0.70	0.004

Table-V shows the laboratory variables and BMI about cases. It is observed that a positive association of BMI and IVRT is existing.

Table 5: Pearson's Correlations Between the Body Mass Index, Laboratory Variables, And Some Echocardiographic Parameters in The Case Group

Details	BMI (*r*)	Insulin (*r*)	HOMA-IR (*r*)	Glucose (*r*)
Em (cm/s)	−0.372	0.047	−0.044	−0.199
Am (cm/s)	−0.276	−0.098	0.071	−0.092
Sm (cm/s)	−0.124	0.192	−0.033	−0.365
Em/Am	−0.042	0.171	−0.130	−0.128
E/Em	0.129	−0.148	0.126	0.368
IVRT (ms)	**0.401**	0.224	−0.125	−0.268
S-VTI (cm)	0.227	−0.252	0.333	0.237
DI (%)	0.336	−0.098	0.143	0.136
LVMI (g/m^2)	−0.332	−0.047	0.117	−0.041

DISCUSSION:

There was a steady rise in our research about the obese individuals. Evident importance is required for the changed life style and weight reduction programs. The situation of obesity with normal blood pressure is unique [4]. Complexities such as hypertension, diabetes, coronary atherosclerosis, LV hypertrophy, cardiac dysfunction and sleep apnea are outlined as the obesity contributing factors [5]. High blood pressure was observed in the fat adult participants. Scarce data was available in terms of the diastolic and systolic BP in the obese children. Insulin resistance, impaired autonomic nervous system and high blood sugar may contribute to the impairment of the cardiac contractility metabolic syndromes cases [6]. Outcomes reflect that baseline BP was < 90th percentile and higher in respectively case and controls. Higher heart beat rate was observed in cases in comparison to the controls. In any category there was no observable clinical myocardial depression [7]. To observe hypertension obese children should be evaluated for heart rate and BP at regular intervals. Previously echocardiographic was the method of evaluation of systolic and diastolic BP; whereas, TDI and PWD are the new methods [8].

EF abnormalities were not observed through echocardiography. Cases were observed with larger left atrium size in comparison to the non-obese cases. Gradual increase in the obese children was observed in the cardiac volume and echocardiography reflected non-documented systolic [9]. Nevertheless, an enhanced diameter of LV mass was observed in obese children. Healthy children were observed with controlled blood pressure and greater LVM [10]. An LVM increase leads to systolic and diastolic dysfunction. There was an association among LVM, LVMI and BMI including related laboratory assessments as shown in Table-V.

The level of LVEDD was observed significantly large in the obese children when compared with the healthy participants [11]. This increase may be attributed to the increased BMI above thirty. TDI and PWD was used for the measurement of the systolic and diastolic BP. Dramatic drop in the E-wave of cases was compared with controls including A-wave and E/A ratio. Table-III & IV show the diastolic function parameters [12]. Statistical difference was observed among Em, Em/Am and Am ratios and IVRT in both the groups. Our research evaluated systolic function through TDI variables including Sm, DI and S‑VTI. S‑VTI is considered as the myocardial systolic function parameter. We failed to observed any difference in S-VTI in the both groups [13]. DI is an assessment parameter of systolic dysfunction and LV longitudinal movement because of the ventricular deformation. There is an association of DI to longitudinal systolic dysfunction and EF, as it tells about the LV longitudinal linear motion. Research also observed the direct association between HR and BMI [14]. LV deformations can be managed through sub-clinical improvements in the obese children. DI is less dependent on the body size and age in comparison to the S-VTI. There is an association of DI with the cardiac complications and mortality. We observed significant variation in both the groups about DI as it is increased in obese children. No association was observed in terms of laboratory parameters, DI and BMI as shown in Table-V. Additionally, pre-clinical regional deformation may be observed in BMI above 30. The form of the diastolic and systolic dysfunction is determined by the TDI and PWD. Fat children were not observed with cardiac dysfunction. As per the observed values of Sm, DI, IVRT and S‑VTI

parameters of our research, subclinical diastolic and systolic dysfunction was observed on obese children with no increase in the BP. On the basis of the results it can be said that a positive relation was present in the BMI and IVRT; furthermore, there was no correlation among HOMA-IR, insulin and fasting glucose with the related variables including TDI and PWD echocardiography as shown in Table-V. There is an impairment of the HOMA-IR before diabetes clinical onset [15].

Fleshy children presented an insulin resistance with an increased risk of T2DM and BP. Obese adults present association of the myocardial deformation and resistance of the insulin, which is also mentioned by other authors. Puberty and gender also affect the insulin resistance and obesity. Male are dominant over females in this incidence. According the research held by Ling, BMI, females and waist has a positive association with HOMA-IR and fasting insulin. According to Cozzolino, there is a corroborative effect on obesity by the insulin resistance in terms of cardiac autonomic regulation and myocardial performance. We can also say that a myocardium subclinical dysfunction and cardiac autonomic system dysregulation are linked with insulin resistance degree.

Our outcomes suggest that the obese children without high BP may result in the shape of cardiac dysfunction of diastolic and systolic nature. Low sample size was the limitation of the research, more research work with heavy sample size is required in this regard. Long-term follow-up was another drawback in the measurement of the weight of the obese children. Furthermore, strict 24 hours' observation of the BP is mandatory for the observation of the diastolic and systolic variations in the BP.

CONCLUSIONS:

There is a relation between the without hypertension obese children and subclinical systolic & diastolic dysfunction. The blood pressure evaluation is proposed including myocardial performance with the help of TDI and PWD in the target population of without hypertension obese children.

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