Severity, duration and phenotype of obesity promote precocious cardiovascular sonographic alterations in childhood obesity

Corica Domenico[1], Aversa Tommaso[1], Oreto Lilia[2], Calabrò Maria Pia[1], Longobardo Luca[2], Catalfamo Marta[1], Alibrandi Angela[3], De Luca Filippo[1], Wasniewska Malgorzata[1].

[1] Department of Human Pathology of Adulthood and Childhood, Unit of Pediatrics, University of Messina- Italy
[2]Department of Clinical and Experimental Medicine, Unit of Cardiology, University of Messina- Italy
[3]Department of Economics, Unit of Statistical and Mathematical science, University of Messina – Italy

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Introduction and Objectives

Childhood obesity is known to be associated with an increased risk of cardiovascular and metabolic complications in adulthood[1]. However, only few evidences on the possible correlation between early cardiovascular and metabolic alterations are available in pediatrics. This research project aimed:

1) To evaluate precocious cardiovascular sonographic modifications in a cohort of overweight (OW) and obese (OB) children and adolescents brought to Outpatient Clinic of Pediatric Endocrinology for first evaluation, compared with normal weight controls.
2) To investigate the association between clinical and metabolic variables and cardiovascular sonographic parameters;
3) To evaluate their relation with two different phenotypes of obesity: metabolically healthy obesity (MHO) and metabolically unhealthy obesity (MUHO)[2].

Material and methods

Fifty-nine OW and OB children and adolescents (range 6-16 years) and twenty matched lean controls underwent to anthropometric, biochemical, echocardiographic and sonographic evaluation of carotids and ascending aorta (AA) assessment. OW and OB subjects were divided in MHO and MUHO.

MUHO was defined as 2 or more cardiometabolic risk factors [2]
Triglycerides ≥ 110mg/dL or on cholesterol medication
HDL-C < 40mg/dL or on cholesterol medication
Blood pressure ≥ 90th percentile for age, gender, and height or on blood pressure medication
Fasting glucose ≥ 100mg/dL or on glucose/insulin medication

Sonographic indices evaluated
Interventricular septum (IVsd)
Diastolic left ventricle posterior wall (PWd)
End-diastolic (LVEDD) and end-sistolic (LVESD) left ventricular diameter
End-diastolic (LVEDV) and end-sistolic (LVESV) left ventricular volume
Left ventricular indexed mass (LV mass i)
Ejection fraction (FE4ch)
Left atrial volume in 4ch view (LAVol4ch) and Left atrial strain
Epicardial fat (PLAX)
Carotid artery intima-media thickness (CIMT)
Carotids pulse wave velocity (PWV)
Beta-index and augmentation index (Aug Index)
Peak early diastolic velocity/peak late diastolic velocity-ratio (E/A-ratio)
Ascending aorta diameters and stiffness

Results

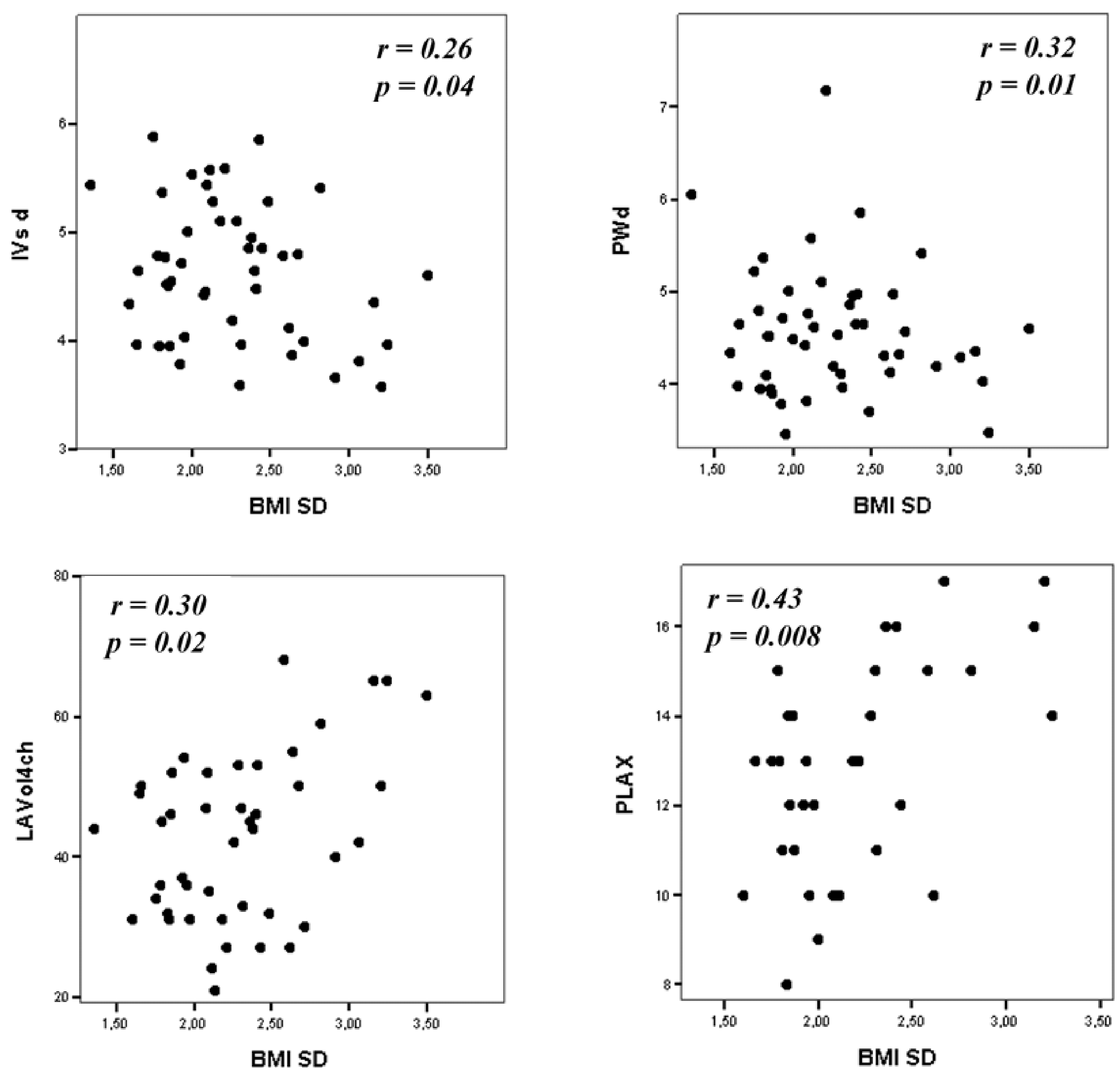
OB and OW children showed significantly (p<0.005) higher systolic blood pressure (SBP), left ventricular (LV) dimensions, CIMT, Beta-index, PWV, **and significantly lower** E/A-ratio, compared to controls.

Among OB and OW children, BMI SD, HOMA-index and SBP were positively related with left atrial (LA) and LV dimension and mass, and with P-Lax (Fig.1). Moreover, SBP was positively related with PWV. BMI SD was negatively related with E/A-ratio.

BMI SD, SBP, uric acid (UC), triglycerides (Tg) were significant predictors of LA and LV dimension and P-Lax, while SBP and duration of obesity were predictors of AA diameters and stiffness.

Furthermore, BMI SD, waist circumference (WC), hip circumference, WC/height-ratio, HOMA-index, Tg, UC, SBP, LV dimensions and mass, P-Lax, CIMT, PWV, Beta-index, Aortic stiffness **were significantly higher among MUHO compared to MHO children.**

Figure 1 – Significant correlation between BMI SD and echocardiographic indices.



Conclusions

Precocious detection of cardiovascular modifications were associated with severity, duration and MUHO phenotype of childhood obesity. MUHO, characterized by higher prevalence of metabolic alterations and early cardiovascular modifications, determines an increased cardiometabolic risk since the pediatric age. Distinction between MHO e MUHO phenotypes is important to plan a personalized approach for the follow-up in obese children.

1- Franks PW, Hanson RL, Knowler WC, et al. Childhood obesity, other cardiovascular risk factors, and premature death. N Engl J Med 2010; 362: 485-93.
2- Camhi SM, Waring ME, Sisson SB et al. Physical activity and screen time in metabolically healthy obese phenotypes in adolescents and adults. J Obes. 2013;2013:984613.