EDITORIAL

Body composition and fat depot assessment: going supersonic to improve cardiometabolic outcomes

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Obesity has become a major epidemic elevating the risk conferred by the known cardiometabolic risk factors, such as dyslipidemia, hypertension, and type 2 diabetes mellitus (T2DM), and leading independently to the development of cardiovascular disease and related mortality.[1,2] The World Health Organization defines obesity as an "abnormal or excessive fat accumulation that presents a risk to health,"[3] effectively denoting an increase in body adiposity. Diagnosis and grading of obesity severity are established on the basis of body mass index (BMI) which, although simple and readily available, provides no information regarding the relative contributions of different body tissues to net weight and, most prominently, fat tissue distribution.[4,5]

An evaluation of the body fat mass and distribution rather than a rough estimation of the total body weight could prove beneficial in estimating individual obesity-related risk and guide clinical decision-making with respect to therapeutic interventions.[6] The functional implications of the expansion of visceral adipose tissue (AT) in particular, such as chronic low-grade inflammation and aberrant adipokine secretion, may play a direct role in obesity-related prognosis-defining complications, while other special deep fat tissue compartments could play accessory roles in myocardial (epicardial fat) and vascular (perivascular fat) function or dysfunction.[7]

Simple measures, such as waist and hip circumference, or the assessment of peripheral skinfold thickness may improve the yield of clinical evaluation.[8] Nevertheless, other quantitative tools, including bioelectrical impedance (BIA), dual-energy X-ray absorptiometry, as well as computed tomography- or magnetic resonance–based methods, are not always readily available, present individual pitfalls, and have not been conclusively validated with respect to their relevance to clinical outcomes.[9] Collectively, there is a lack of practical methods for the assessment of fat compartments with a direct impact on clinical practice.

In their latest study published in *Polish Archives of Internal Medicine*, Haberka et al[10] attempted to prospectively investigate the effects of parameters related to body adiposity, body composition, and fat depots on metabolic outcomes among high-risk patients. Of note, emphasis was put on ultrasound-based indices not routinely implemented in clinical practice, such as preperitoneal fat thickness (PreFT) and extra-media thickness (EMT), as measures of the truncal and perivascular fat depots, respectively. The study involved 143 patients undergoing coronary angioplasty for stable coronary artery disease at baseline. The primary outcomes that were assessed 8 years after the initial evaluation were the occurrence of new-onset T2DM and insulin resistance (IR). Multiple body measurements (BMI, waist and hip circumferences, BIA-assessed absolute and relative body fat, peripheral skinfold thicknesses) and ultrasound indices (PreFT, EMT, and intima-media thickness [IMT], as well as pericardial and epicardial thickness) were implemented as candidate predictors of new-onset T2DM or IR.

Unsurprisingly, there were numerous significant associations between both outcomes and the bulk of tested parameters in univariable analyses, which were attenuated in multivariable models, since a degree of confounding correlations between different measures of body compositions is expected. In the multivariable analyses, only the body surface area and PreFT were associated with the occurrence of IR, while in a further adjusted model including all ultrasound-based indices, both EMT and PreFT emerged as independent predictors of IR development. In contrast, only

BIA-derived absolute fat mass and high-density lipoprotein cholesterol concentrations were independent predictors of T2DM development, while no independent associations with respect to this outcome were noted with ultrasound indices in the fully adjusted model.

These results indicate the potential usefulness of ultrasound-based measures of body composition in predicting prognosis-relevant metabolic outcomes. At the same time, they highlight the current lack of recommendations for comprehensive and individualized, pathophysiology-based characterization of obesity and risk stratification. Currently, BMI constitutes the sole anthropometric measure upon which clinical decision-making is based with respect to obesity diagnosis and management. Of note, in the study by Haberka et al,[10] BMI was not predictive of IR nor T2DM development when included in the multivariable models together with the rest of the tested parameters. This may indicate that superior information from an end point–driven perspective may be obtained with the use of more comprehensive measures than BMI.

PreFT may constitute a promising modality for quantitative assessment of deep subcutaneous tissue, which is a frequently overlooked AT compartment with shared physiological features between subcutaneous and visceral AT.[11] In concordance with the findings of Haberka et al[10] regarding its independent relationship with IR, PreFT quantified sonographically has been shown to be positively associated with the severity of liver steatosis and fibrosis in individuals with T2DM,[12] both of which are established correlates of IR. Regarding the same outcome, EMT also emerged as an independent predictor of IR development, according to a limited number of reports that have highlighted its relationship to obesity and the metabolic syndrome[13] on the one hand, and cardiovascular risk features on the other.[14]

Given the pathogenetic continuum between IR and T2DM, the lack of a corresponding association of ultrasound measures with the probability of T2DM development in the study by Haberka et al[10] would at first seem unexpected, although it may be a mere result of the limited number of events, follow-up duration, or other statistical power–related issues. An additional reason may be that T2DM eventually develops through a series of changes which include the expansion and dysfunction of AT resulting in IR, but additionally require a relative pancreatic β-cell failure as a crucial last step.

In any case, the results presented by Haberka et al[10] further support the concept that implementation of additional qualitative indices of body composition, rather than plain somatometry, may be valuable in improving the clinical outcomes in the frame of obesity. Importantly, ultrasound-based measures, such as PreFT or EMT, are promising in this respect, given their simplicity, low cost, and availability. Apart from the need for further prospective studies in larger populations to replicate the presented findings, it should be stressed that being operator-dependent to a certain degree, ultrasound-based measurements are subject to interpretive errors and inter-rater variability. Hence, as is also the case with the use of IMT in cardiovascular risk assessment,[15] measurement standardization and reproducibility issues are obstacles that need to be overcome before these modalities are integrated in clinical practice.

ARTICLE INFORMATION

CONFLICT OF INTEREST None declared.

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