An Easy Way to Detect Cardiovascular Risk

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The cardiovascular risk quantitation is a golden desideratum for clinical management, as the possibility of accurately assigning the patient to a risk class allows for appropriate conduct targeted at the respective risk class [1-3]. It is also important for patients with cardiovascular risk, which will undergo different types of surgeries [4,5]. The quantification of cardiovascular risk in people with DM and CV disease is not relevant, because the risk is very high, however [6-9]. Several methods accepted by international clinical guidelines for cardiovascular risk calculation are available: Framingham score, SCORE diagram, UKPDS score, and Archimedes model. The original Framingham Risk Score [10,11] had been published in 1998 [12] and provided predictive morbidity for 10 years only for coronary territory.

The first Framingham Risk Score included age, sex, LDL cholesterol, HDL cholesterol, blood pressure (and whether the patient is treated or not for his/her hypertension), diabetes, and smoking. It estimated the 10-year risk for coronary heart disease (CHD). It performed well and correctly predicted 10-year risk for CHD in American men and women of European and African descent.

The current version of the Framingham Risk Score was published in 2008 and help us to identify the cardio-vascular and cerebrovascular risk, the risk of heart failure or peripheral vascular diseases [13-15]. The publishing body is the ATP III, i.e. the Adult Treatment Panel III, an expert panel of the National Heart, Lung and Blood Institute, which is part of the National Institutes of Health (NIH), USA. The updated version in 2008 was modified to include dyslipidemia, age range, hypertension treatment, smoking, and total cholesterol, and it excluded diabetes, because Type 2 diabetes meanwhile was considered a CHD Risk Equivalent, having the same 10-year risk as individuals with prior CHD. Patients with Type 1 diabetes were considered separately with slightly less aggressive goals; while at increased risk, no study had shown them to be at equivalent risk for CHD as those with previously diagnosed coronary disease or Type 2 diabetes [16,17]. Primary prevention is based on the modifiable risk factors control in the general population, but especially in the population at risk of developing T2DM [18]. In the general population, prevention in any type of disease cannot be achieved quickly or by only one method, achieving this goal by requiring a methodical and sustained approach over a long period of time [19,20].

In the daily practice, it is necessary to introduce an easy instrument, namely visceral adiposity index (VAI), to assess the value of cardiovascular risk and to be useful in initiating early management measures to reduce cardiovascular morbidity and mortality and, implicitly, the costs [21-23].

This study aims to establish the relationship between the visceral adiposity index (VAI) and the cardiovascular risk calculated by the Framingham score and to observe if VAI could be used in daily clinical practice to assess cardio-metabolic risk in patients with visceral obesity.

Experimental part
Materials and method
The study was conducted over 3 years (2011-2014) and included patients with diabetes mellitus, prediabetes and subjects without diabetes or prediabetes. The study,

Key words: visceral adiposity index, diabetes, prediabetes, cardiovascular risk
Epidemiologically, transversally, non-interventional, was conducted by analyzing 300 subjects divided into three subgroups, as follows: Subgroup 1 included 100 pre-diabetic patients; Subgroup 2 included 100 patients with type 2 diabetes and subgroup 3 (control) of 100 individuals randomly recruited without diabetes or prediabetes.

The physical examination consisted in the measurement of the height, weight, waist circumference, body mass index (BMI), systolic (SBP), and diastolic blood pressure (DBP) using standard procedures. Hypertension was defined as SBP $\geq 140$ mmHg and/or DBP $\geq 90$ mmHg and/or personal history of hypertension and/or taking antihypertensive therapy. All samples were collected in a fasting state, and the biochemical assays were performed in laboratories according to standardized procedures.

Fasting plasma glucose (FPG), triglycerides (TG), total cholesterol (TC), high-density lipoprotein (HDL) cholesterol levels were determined using enzymatic methods. The low-density lipoprotein (LDL) cholesterol levels were calculated using the Friedwald formula ($LDL = TC – HDL – \frac{TG}{5.0}$) if total TG levels were $< 400$ mg/dL. The impaired glucose regulation (IGR) - previously known and unknown diabetes, prediabetes - was defined according to the 2012 American Diabetes Association guidelines [23], based on FPG, HbA1c and 2h plasma glucose during oral glucose tolerance test or self-reported diagnosis. Hypertriglyceridemia was considered when TG $\geq 150$ mg/dL or drug treatment for hypertriglyceridemia, and hypo-HDL cholesterolemia was considered when HDL levels were $< 40$ mg/dL in men or $< 50$ mg/dL in women or drug treatment for reduced HDL [24]. Hypercholesterolemia was considered when TC $\geq 200$ mg/dL and/or statin therapy was used, and hyper-LDL cholesterolemia was considered when LDL $\geq 100$ mg/dL and/or statin therapy was used [25].

The risk of developing CVD was estimated with the Framingham 10-year CVD risk score [26]. The CVD risk was stratified into low (Framingham CVD risk score $< 10$ %) and moderate/high (Framingham CVD risk score $\geq 10$ %). The calculation of visceral adiposity index, according to gender, was performed using the following formulas:

For males:

$$\text{VAI} = \left(\frac{WC}{3.968 + (1.88 \times BMI)}\right) \times \left(\frac{TG}{1.03}\right) \times \left(\frac{1.31}{HDL}\right)$$

For females:

$$\text{VAI} = \left(\frac{WC}{36.58 + (1.89 \times BMI)}\right) \times \left(\frac{TG}{0.81}\right) \times \left(\frac{1.52}{HDL}\right)$$

where, VAI - visceral adiposity index, WC - waist circumference, BMI - body mass index, TG - triglycerides, HDL - HDL cholesterol.

The data obtained were recorded as a Microsoft Excel spreadsheet and analyzed for each of the three subgroups using Microsoft Excel (Microsoft Corp., Redmond, WA, USA) together with XLSTAT 2014 for Microsoft Excel (Addinsoft SARL, Paris, France) and IBM SPSS Statistics 17.0 (IBM Corporation, Armonk, NY, USA) to analyze the relationships between clinical and paraclinical data of patients. For statistical analysis, the SPSS (Statistical Package for Social Sciences) version 17.0 for Windows was used.

Results and discussions

Each subgroup included patients equally divided by age, sex, lipid lowering and antihypertensive therapy. The decades of age in which the patients of each lot were assigned are shown in Table 1.

By calculating VAI, we obtained an average of 4.99 for pre-diabetic patients, greater than 6.22 for patients with DM and the smallest mean of 4.88 being found in the control subgroup, statistically significant difference between subgroups ($p = 0.039$) (Table 2).

The cardiovascular risk assessment by the Framingham score was as follows: in the subgroup of pre-diabetic patients, most patients (56%) were in the moderate risk category, 24% at high risk and 20% at low risk (Figure 1).

Most patients in the type 2 DM subgroup, 70% had high cardiovascular risk, 20% moderate and only 10% of type 2 DM patients had low cardiovascular risk (Figure 2).

In the control subgroup, most subjects (64%) were in the low cardiovascular risk category, 32% were in the moderate risk category and only 4% were at high risk (Figure 3).
Lipid lowering therapy was similar in all three subgroups. Shown in Figure 4.

Cardiovascular risk increases as VAI value is higher, as is the moderate cardiovascular risk category with a mean VAI of 4.704 and a value of 6.148 in average VAI of 4.238, the moderate cardiovascular risk category was associated with an average VAI of 4.704 and a value of 6.148 in the high cardiovascular risk category. In conclusion, the cardiovascular risk increases as VAI value is higher, as is shown in figure 4.

By correlating the mean VAI with the cardiovascular risk category evaluated by the Framingham score, there were high statistical differences (p = 0.001). Thus, the low cardiovascular risk category was associated with an average VAI of 4.238, the moderate cardiovascular risk category with a mean VAI of 4.704 and a value of 6.148 in the high cardiovascular risk category. In conclusion, the cardiovascular risk increases as VAI value is higher, as is shown in figure 4.

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It should be noted that the percentage of patients with lipid lowering therapy was similar in all three subgroups.

The term of cardio-metabolic risk was developed by the American Heart Association and others [24,28] to describe the overall risk of developing type 2 DM and cardiovascular disease. Abdominal obesity, insulin resistance and dysfunction due to visceral fat, ageing, treatment with many types of drugs are just some key components of a constellation of metabolic abnormalities [29-32] linked to the excess energy resulting from a sedentary lifestyle and combined with excessive calories consumption, which characterizes the cardio-metabolic risk [33-38]. It can also increase the risk of kidney failure or even triggering the development of some malignancy [39-43].

To identify visceral obesity, the most commonly used clinical parameter today is waist circumference (WC). However, WC alone does not help distinguish subcutaneous adipose tissue from visceral (both omental and mesenteric) [44-47]. This is a considerable disadvantage; that's why VAI could be used as a surrogate marker of fatty tissue dysfunction. In addition, some recent studies on rats show the important influence of oxidative stress [47-50].

The results of our study were consistent with those obtained by Marotta et al., who also used VAI as a useful parameter in cardiovascular risk assessment and observed that higher VAI values correlated with increased cardiovascular risk over time, while lower values correlated with low cardiovascular risk [51]. Each score used for cardiovascular risk assessment have their limits. The Framingham score has as a limit the prediction only for coronary risk, so VAI could become a prediction tool for DM, too.

Conclusions
Cardiovascular risk assessment using the Framingham score confirmed, as expected, the highest risk for diabetes patients followed by those with prediabetes, the lowest risk being seen in patients of the control subgroup. In conclusion, VAI is an easily diagnostic tool, the simplicity of AC and BMI measurement, the TG and HDL assessment, make it an easy to apply index for the evaluation of adipose visceral dysfunction. VAI could therefore be a useful tool in daily clinical practice and in population studies to assess cardio-metabolic risk associated with visceral obesity.

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