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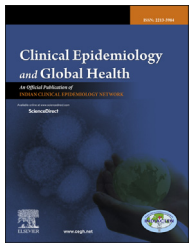

Original Article

# Visceral fat rating is a useful indicator in risk assessment among coronary artery disease patients treated with aggressive lipid lowering therapy

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ABSTRACT

*Background:* Visceral fat rating (VFR), calculated by bioelectrical impedance, is a new parameter associated with obesity and Coronary Artery Diseases (CAD). We have attempted to assess population of treated CAD patients classified based on VFR.

*Methods:* We enrolled consecutive patients having documented CAD who had received prior treatment along with high-dose lipid lowering drugs for a minimum of 6 wks and compared with healthy controls. CAD patients with VFR >12 were labeled as High Visceral fat CAD (HVC) while those with VFR ≤12 were grouped as Low Visceral fat CAD (LVC). Established anthropometric indices like waist circumference (WC) and Body Mass Index (BMI) were measured. We used bioelectrical impedance to measure VFR using a device called *InnerScanV (TANITA, Tokyo)*. A complete lipid profile was recorded. Groups were compared by chi-square, t-test and one-way analysis of variance. Multivariate analysis was done for identifying risk factors.

*Results:* 303 subjects were enrolled, including 150 CAD patients and 153 healthy controls. Among CAD group, there were 74 (49.3%) HVC and 76 (51.7%) LVC patients. On comparing treated HVC and treated LVC patients, HVC patients had expectedly higher WC, BMI and higher Triglycerides (TG), total cholesterol (TC) and LDL cholesterol. On comparing the patients with healthy controls, HVC group again had higher WC, BMI, LDL, TC:HDL ratio, LDL:HDL ratio and lower HDL levels. On the other hand, LVC patients had a lower BMI than the healthy controls and there was no difference in the lipid parameters, apart from lower HDL in LVC patients, between the two groups. VFR along with WC, HDL, LDL:HDL and TC:HDL were independent risk factors among treated CAD patients. WC, HDL, LDL:HDL and TC:HDL ratios were risk factors among LVC patients while in addition to these, BMI and LDL were extra risk factors among HVC patients and thus associated with VFR.

*Conclusion:* High visceral fat is associated with deranged anthropometric measurements and lipid profile. We hypothesize that HVC patients might be resistant to conventional treatment, while LVC patients respond well to aggressive lipid lowering therapy. HVC patients are also associated with more risk factors than LVC patients.



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## 1. Introduction

At present, the population at risk of Coronary Artery Diseases (CAD) is recognized by various criteria, for example the presence of metabolic syndrome, which includes the conventional risk factors like hypertension, diabetes, hyperlipidemia and increases waist circumference or obesity. Abdominal obesity is also proposed to be the major contributor of associated health risks. Notably, visceral fat, rather than the subcutaneous part of abdominal fat, is considered the marker of 'dysfunctional adipose tissue' and has emerged of central importance.[1] It has also become evident that the accumulation of visceral fat not only accompanies but antedates the onset of the components of the metabolic syndrome and related disorders, e.g., insulin resistance, hypertension and coronary heart disease. Recently, with the advent of Bioelectrical Impedance Analysis (BIA) technique, direct and accurate estimate of visceral fat has become possible.[2] However, the association of visceral fat with CAD has not been studied extensively yet. Therefore, in our present study we have attempted to analyze the treated patients of Coronary Artery Disease (CAD) on the basis of their visceral fat rating (VFR) measured by BIA. We aim to study VFR as a risk factor along with conventional CAD risk factors in treated CAD patients. We further intend to study the profile of treated CAD patients population subdivided based on VFR and find association of conventional risk factors in each subdivision.

## 2. Methods

This is a cross-sectional observation study. We enrolled consecutive patients attending as out-patients at the Cardiology Department. Subjects were categorized into 2 groups; documented CAD patients and normal healthy individuals as controls. Documented CAD patients included had a history of Acute ST elevation or Non-ST elevation Myocardial Infarction; or Chronic stable angina with treadmill test positive or coronary angiography proven CAD and having received prior treatment with high-dose lipid lowering therapy (typically atorvastatin $\geq$40 mg/d) for at least the prior 6 weeks. The documented CAD patients were further subdivided into High Visceral fat CAD (HVC) and Low Visceral fat CAD (LVC) patients. HVC group includes CAD patients with VFR >12 and LVC includes CAD patients with VFR $\leq$12. VFR greater than 12 is considered abnormal and signifies the presence of high visceral fat. The healthy individuals included those without documented CAD or being at high risk for the same, i.e., those not qualifying as Metabolic Syndrome based on the NCEP-ATPIII criteria[3] or having Framingham 10 years risk score[4] of less than 10% and not on any lipid lowering therapy. These independent healthy subjects were recruited from OPD staff, unrelated accompaniments of CAD patients and patients who visited the OPD for routine check-ups or other ailments.

Exclusion criteria included all subjects younger than 35 years or older than 75 years, those having cardiac pacemaker or other metallic implants in body, patients of neuromuscular or skeletal disorders and limb anomalies. After an informed written consent, a detailed history about smoking, alcohol intake, previously diagnosed diabetes or hypertension, drug intake and family history for CAD was taken. Anthropometric indices of weight, height and waist circumference (WC) were measured and Body Mass Index (BMI) was calculated. A fasting blood sample for complete lipid profile comprising of triglycerides (TG), total cholesterol (TC), low density lipoprotein (LDL) and high density lipoprotein (HDL) was done at the Department of Biochemistry. For lipids levels, we referred to NCEP-ATPIII Guidelines.[5] According to these standard guidelines, hypercholesterolemia is defined as TC > 200 mg/dl, LDL-C>100 mg/dl, TG > 150 mg/dl and HDL-C<40 mg/dl in males or HDL-C<50 mg/dl in females. Dyslipidemia is defined as one or more abnormal parameter.

We used InnerScanV (TANITA Inc, Tokyo), which works on the principal of BIA, to measure VFR. The BIA device applies an alternating current to electrodes placed on subjects' hand and feet and yields a measure of body resistance and reactance. Body composition is estimated based on the specific resistivity offered by different body tissues.[6]

## 3. Statistical analysis

Data were summarized as Mean ± SE. In Tables 1 and 2, categorical parameters were analyzed using chi-square test while continuous parameters were analyzed by *t*-test. In Table 3, continuous data from three groups were analyzed by one-way analysis of variance (ANOVA). In Tables 4 and 5, multivariate analysis was performed with adjustment for all significant socio-demographic parameters i.e., age, sex, smoking, diabetes and hypertension. GraphPad Prism 3.0 software was used for chi-square, STATISTICA (Windows

**Table 1 – Comparison of all CAD patients with healthy controls.**

| Characteristics | Healthy controls ($n$ = 153) | All CAD patients ($n$ = 150) | $p$-value |
|---|---|---|---|
| Age (years) | 39.99 ± 0.79 | 57.88 ± 0.92 | <0.0001 |
| Sex (males) | 64 (41.8%) | 122 (81.3%) | <0.0001 |
| Smoking | 19 (12.4%) | 61 (40.7%) | <0.0001 |
| Diabetes | 14 (9.2%) | 78 (52.05) | <0.0001 |
| F. history | 13 (8.5%) | 18 (12.0%) | 1.012 |
| Hypertension | 32 (20.9%) | 68 (45.3%) | <0.0001 |
| Alcohol | 15 (9.8%) | 24 (16%) | 0.107 |
| VFR | 7.77 + 0.26 | 11.30 ± 0.38 | <0.0001 |
| WC (cm) | 85.88 ± 0.78 | 94.73 ± 0.83 | <0.0001 |
| BMI (kg/m$^2$) | 24.28 ± 0.33 | 23.96 ± 0.35 | 0.512 |
| TG (mg/dl) | 136.76 ± 5.37 | 140.63 ± 4.65 | 0.586 |
| TC (mg/dl) | 158.21 ± 3.42 | 160.83 ± 3.22 | 0.577 |
| HDL (mg/dl) | 39.47 ± 0.97 | 35.65 ± 0.64 | 0.001 |
| LDL (mg/dl) | 91.38 ± 3.08 | 97.06 ± 2.83 | 0.211 |
| TC/HDL | 4.32 ± 0.13 | 4.70 ± 0.12 | 0.064 |
| LDL/HDL | 2.58 ± 0.12 | 2.86 ± 0.10 | 0.076 |

CAD = Coronary Artery Disease; LVC = Low visceral fat (≤12) CAD patients; HVC = High visceral fat (>12) CAD patients; WC = Waist Circumference, BMI = Body Mass Index; TG = Triglyceride, TC = Total Cholesterol; HDL = High Density Lipoprotein; LDL = Low Density Lipoprotein; BF% = Body Fat Percentage; VFR = Visceral Fat Rating.