Regional and overall aortic function in non-diabetic individuals with insulin resistance and normal glucose tolerance

Stakos D1, Boudoulas KD1, Schuster D3, Tsilakas D1, Osei K1, Boudoulas H1

1Democritus University of Thrace Medical School, Department of Cardiology, Alexandroupolis, Greece
2Division of Cardiovascular Medicine, The Ohio State University, Columbus, Ohio, USA.
3Division of Endocrinology, Diabetes and Metabolism, Department of Internal Medicine, The Ohio State University, Columbus, Ohio, United States of America.

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Purpose
It is well appreciated today that aortic function in patients with diabetes mellitus and metabolic syndrome is abnormal.1,2 Glucose tolerance status is also associated with arterial elastic properties.3 It is also known that the structure of the aortic wall varies in different areas of the aorta.4 Regional and overall aortic function, however, in non-diabetic individuals with insulin resistance (IR) and normal oral glucose tolerance test (OGTT) has not been well defined.

Methods
One hundred and eighty one non-diabetic individuals (44 males) with mean age 42±8 years with a normal OGTT and IR as defined by insulin sensitivity index (ISI) were studied. ISI was estimated from serial blood measurements of insulin and glucose during the intravenous glucose tolerance test. Specifically, with the subject in the supine position, two intravenous needles were inserted into the forearm veins and kept patent with 0.9% normal saline infusion. One intravenous line was used to draw blood samples, and the other was used to administer the intravenous glucose and exogenous insulin, as previously described.5,6 Four blood samples were obtained at t = −20, −10, −5, and 0 min for basal serum glucose, C-peptide, and insulin concentrations. The average of the four samples was considered the basal level. Thereafter, 0.3 g/kg glucose (50 ml of 50% dextrose water) was infused over a 1-min period. At t = 19 min, intravenous insulin (0.05 units/kg, Humulin; Eli Lilly, Indianapolis, IN) dissolved in 30 ml of 0.9% normal saline was infused over 60 s. Blood samples were obtained at frequent intervals (t = 2, 3, 4, 5, 6, 8, 10, 12, 16, 19, 22, 24, 25, 27, 30, 40, 60, 70, 90, 120, 140, 150, 160, and 180 min) for serum glucose, C-peptide, and insulin levels. All samples were centrifuged at 4°C, and the sera were frozen and stored at −20°C until assayed.

Results
Fasting plasma glucose was <110mg/dL and plasma glucose 2 hours after 75g OGTT was <140mg/dL in all participants. Ascending AoD was directly related to ISI quartiles (ANOVA, p<0.01, figure 1); ascending AoSI was inversely related to ISI quartiles (ANOVA, p=0.03, figure 2). In contrast, abdominal AoD (p=0.33) and abdominal AoSI (p=0.38) were not related to ISI (figures 3 and 4). PWVc-f did not show a relationship with ISI (p=0.77) but pulse pressure demonstrated an association with ISI (figure 5). After adjustment for age, gender, lipid profile and BMI, ISI remained significantly associated with ascending AoD (t=2.28, p=0.03) and AoS (t=−2.01, p=0.04).

Aortic elastic properties
Ascending and abdominal aortic distensibility (AOD) were assessed by echocardiography using the formula: AoD (cm² x dynes⁻¹ x 10⁶) = 2 x [(systolic aortic diameter) - (diastolic aortic diameter)] / (diastolic aortic diameter) x (pulse pressure). Ascending and abdominal aortic stiffness index (AoSI) were assessed by echocardiography using the formula: log n[pulse pressure] x diastolic diameter / [(systolic aortic diameter) - (diastolic aortic diameter)].8

References