# The impact of obesity on subendocardial viability ratio

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**Background.** Increased arterial stiffness is the consequence of atherosclerosis and is linked with myocardial ischemia. Applanation tonometry non-invasively measures carotid-femoral pulse wave velocity (cfPWV) and pulse wave analysis (PWA) from which subendocardial viability ratio (SEVR) can be derived (Table 1). The effect of obesity on arterial stiffness is mainly through the high prevalence of traditional atherosclerosis risk factors in these patients, with some studies showing an impact through changes in endothelial function as well.

**Methods.** 125 patients (64% male, 36% female) who were hospitalised due to planned coronary angiography at the Department of Cardiology and Angiology (University Medical Centre Maribor) between January 1st 2018 and February 1st 2020, were included. Basic demographic data and comorbidities were recorded. Arterial stiffness parameters were derived with applanation tonometry (SphygmoCor, AtCor Medical, Ltd., Sydney, Australia). Patients were divided into group 1 (Body Mass Index (BMI)<30 kg/m$^2$, n=77) and group 2 (BMI≥30 kg/m$^2$; n=48) and then compared. For statistical analysis, SPSS® version 22 was used.

**Results.** Patients in group 1 were younger (63.3±9.9 vs 66.±8.0 years, p=0.033), had higher SEVR (170.0±34.4 vs 154.5±29.7%, p=0.011) and lower cfPWV (9.4±2.6 vs 11.7±2.7 m/s, p=0.0001). Patients in group 1 had slightly higher estimated glomerular filtration rate (eGFR) by using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) creatinine equation (77.3±17.0 vs 72.3±18.0 ml/min/1,73m$^2$, p=0.126) and lower presence of macrovascular coronary artery disease (CAD) (64.9 vs 72.9%, p=0.43). Ankle-brachial index values were nearly identical in group 1 and 2 as well (1.05±0.1 vs 1.04±0.1, p=0.712). There were no differences in traditional atherosclerosis risk factors and other arterial stiffness parameters. The differences between both groups are presented in Table 2.

Multiple regression analysis with SEVR as dependent variable and BMI, gender, eGFR, CAD, and smoking status as independent variables, showed a statistically significant impact of BMI (B=-0.250, p=0.004) and female gender (B=-0.253, p=0.006) on SEVR values.

**Table 1. Arterial stiffness parameters and their definitions.**

| Arterial stiffness parameter | Definition |
|---|---|
| Carotid-femoral pulse wave velocity - cfPWV (m/s) | Pulse wave distance between two measuring sites (carotid and femoral artery) divided by pulse transit time (measured by electrocardiographic monitoring). |
| Pulse pressure - PP (mmHg) | Difference between systolic and diastolic pressure. |
| Augmentation pressure - AP (mmHg) | Difference between systolic and inflection pressure. |
| Augmentation index - AIx | AP divided by PP. |
| AIx @ 75 (%) | AIx adjusted for heart rate at 75 beats per minute. |
| Ejection duration - ED (ms) | Duration of left ventricular systolic ejection. |
| Ejection duration index - EDI (%) | The ratio of the duration of systolic ejection to the total duration of the heart cycle. |
| Subendocardial viability ratio - SEVR (%) | The diastolic area under the curve divided by the systolic area under the curve, derived from the pulse wave curve. |

**Table 2. The differences between both groups of patients.**

| Parameter | Group 1 (BMI<30 kg/m$^2$) | Group 2 (BMI≥30 kg/m$^2$) | p |
|---|---|---|---|
| Age (years) | 63.3±9.9 | 66.±8.0 | **0.033** |
| Body Mass Index (kg/m$^2$) | 25.6±2.6 | 32.8±2.7 | 0.772 |
| Estimated GFR (ml/min/1.73 m$^2$) | 77.3±17.0 | 72.3±18.0 | 0.126 |
| Mean ABI | 1.05±0.1 | 1.04±0.1 | 0.712 |
| SEVR (%) | 170.0±34.4 | 154.5±29.7 | **0.011** |
| cfPWV (m/s) | 9.4±2.6 | 11.7±2.7 | **0.0001** |
| CAD (%) | 64.9 | 72.9 | 0.43 |

**Conclusion.** Higher BMI and female gender are independently associated with lower SEVR, even in absence of macrovascular CAD. This could be due to accelerated endothelial dysfunction often observed in these patients.

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