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Poster presentation

Impact of left ventricular volume and mass indexation method on the influence of obesity in a free-living population

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Introduction

Increased left ventricular (LV) volume and mass are risk factors for increased cardiovascular disease. To account for differences in body size, LV parameters are generally indexed to height (HT) or body surface area (BSA). Increased body mass index (BMI), a measure of obesity, seems associated with increased LV volume and mass, but obesity is also associated with hypertension, potentially confounding relationships between BMI and LV volume and mass.

Purpose

We sought to determine the impact of indexation method on relationship between LV volume and mass and adiposity, i.e., overweight (OW, BMI 25.0-29.9 kg/m^2), obese (OB, BMI ≥30) versus normal weight (NL, BMI 18.5-24.9) in a never-hypertensive population.

Methods

A subsample of 1794 members of the Framingham Heart Study Offspring cohort underwent CMR. Breath hold cine SSFP (TR3.0/TE1.5/FA 60°/1.56 × 1.92-mm^2/THK 10-mm/0 gap) was used to encompass the LV in the short-axis orientation. LV contours were traced at end-diastole and end-systole to determine LV volumes (EDV, ESV) and mass. Offspring members have undergone comprehensive physical examinations every 3-4 years since 1971. Only Offspring free of hypertension (SBP≤140, DBP≤90 mmHg) on all examinations who never took antihypertensive medications were included in analysis. LV volumes and mass were indexed to HT and BSA. Sex-specific comparison of raw and indexed LV volumes and mass among NL, OW and OB groups used generalized linear models with multivariate correction for clinical covariates (blood pressure, cholesterol, age, fasting glucose).

Results

Of the 1794 Offspring scanned, 820 (50.2%) were never hypertensive. Men (n = 319) had significantly greater LV EDV, ESV and mass than women (n = 501) in each BMI category regardless of method of indexation ($p < 0.01$ all comparisons). The Table shows that in women EDV, ESV and mass, raw and indexed to HT, increased with greater BMI category (p for trend < 0.02 for all). In men mass ($p = 0.001$) and mass/HT ($p < 0.0001$) increased with BMI, but EDV and ESV did not ($p > 0.29$ all). Indexation to BSA showed decreased EDV and ESV with greater BMI category in both sexes. In men there was no difference in mass/BSA, while this decreased minimally but significantly in women ($p = 0.002$), Table 1.

Conclusion

LV volumes and mass in women, and mass in men increases with greater BMI. Indexation to HT preserves these relationships, but indexation to BSA shows decreased LV volumes with greater BMI in both sexes. Whether HT, BSA or another quantity is the optimal method of indexation to account for adiposity remains to be determined.

Table 1: Left ventricular volume and mass versus BMI category

	Men: NL	Men: OW	Men: OB	Men: p for trend	Women: NL	Women: OW	Women: OB	Women: p for trend
EDV, ml	144.0 ± 28.9	145.9 ± 25.5	145.9 ± 25.3	0.75	104.7 ± 16.5	107.6 ± 19.1	118.5 ± 22.2	<0.0001
ESV, ml	52.1 ± 15.0	51.3 ± 14.7	49.1 ± 13.1	0.29	34.0 ± 8.7	35.2 ± 10.8	37.8 ± 12.1	0.014
Mass, g	116.6 ± 21.0	124.7 ± 21.1	131.7 ± 21.9	0.0011	77.9 ± 12.5	82.4 ± 13.7	93.3 ± 16.7	<0.0001
EDV/HT, ml/m	80.8 ± 15.1	82.6 ± 19.8	83.2 ± 13.8	0.34	64.1 ± 9.2	66.6 ± 10.6	72.9 ± 12.2	<0.0001
ESV/HT, ml/m	29.2 ± 8.0	29.1 ± 8.1	28.0 ± 7.3	0.49	20.8 ± 4.9	21.8 ± 6.3	23.2 ± 7.1	0.0035
Mass/HT, g/m	65.4 ± 10.2	70.8 ± 11.4	75.1 ± 11.9	<0.0001	47.7 ± 6.5	51.1 ± 7.9	57.4 ± 9.4	0.0001
EDV/BSA, ml/m2	75.3 ± 13.5	71.5 ± 11.8	66.3 ± 10.4	0.078	63.6 ± 8.7	60.6 ± 9.2	59.1 ± 8.5	<0.0001
ESV/BSA, ml/m2	27.2 ± 7.2	25.1 ± 7.0	22.3 ± 5.5	0.0002	20.6 ± 4.9	19.8 ± 5.6	18.8 ± 5.4	0.0046
Mass/BSA, g/m2	60.9 ± 8.8	61.2 ± 9.8	59.8 ± 8.9	0.25	47.7 ± 6.5	46.5 ± 6.8	46.7 ± 7.0	0.0024