Supplemental Materials

Methods

Echocardiography

Patients were examined in the partial left decubitus position along the parasternal long and short axes and from apical four-chamber, two-chamber and long axis views. Electrocardiography was recorded simultaneously. Recordings of each subject included five cardiac cycles and were digitally stored for offline analysis using Echopack software version 4.0.4 (GE Vingmed Ultrasound AS). All measurements were performed according to principles described in Recommendations for Chamber Quantification [1].

Left ventricular ejection fraction (LVEF) was estimated using the Simpson’s rule. Left ventricle mass (LVM) was assessed by Devereux formula: 0.8{1.04[([LVEDD + IVSD + PWD]3 - LVEDD3 )]} + 0.6, where LVEDD, IVSD, and PWD represent left ventricular end-diastolic diameter, interventricular septal and posterior wall thickness in end-diastole obtained from 2D recordings. Body surface area (BSA) was calculated using the formula: (0.007184 x weight0.425 x height0.725). LV hypertrophy (LVH) was calculated using indexing to BSA, and it was diagnosed in men if LVM/BSA was > 115 g/m2 and in women if LVM/BSA was > 95 g/m2 [1].

Diastolic function was assessed on the basis of criteria included in recent Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography [2]. Transmitral blood flow Doppler signals were used to evaluate peak early (E) and late (A) diastolic transmitral flow velocities. Pulse-wave tissue Doppler imaging was used to measure peak early (E’) and late (A’) diastolic velocities of mitral annulus displacement at two acquisition sites: septal and lateral. To calculate E/E’ ratio, we divided transmitral E by E’ averaged from two acquisition sites. Left atrium maximum volume index (LAVI) was calculated by correcting volume of left atrium obtained by the method of disks by body surface area. Continuous wave Doppler was used to obtain the highest tricuspid regurgitation systolic jet velocity. Diastolic dysfunction was diagnosed if more than half of following variables met the cut-off values: 1) E/E’ ratio was > 14; 2) septal early diastolic mitral annular velocity (E’ivs) was < 7 cm/s or lateral early diastolic mitral annular velocity (E’lw) was < 10 cm/s; 3) tricuspid regurgitation velocity was > 2.8 m/s; 4) LAVI was > 34 ml/m2.

References

1. Lang RM, Badano LP, Mor-Avi V, et al. Recommendations for Chamber Quantification by Echocardiography in Adults: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. J Am Soc Echocardiogr. 2015; 28:1-39.e14.
2. Nagueh SF, Smiseth OA, Appleton CP, et al. Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. Eur Heart J Cardiovasc Imaging. 2016; 17(12):1321-1360.

Table 2. Comparison of cardiac and retinal parameters between groups of normotensive subjects (NT) hypertensive patients (HT) with and without cardiac damage.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | NT(N=32) | HTwithout cardiac damage (N=55) | HTwith cardiac damage (N=33) | P-valueNT vs. HT without cardiac damage | P-valueNT vs. HT with cardiac damage | P-valueHT with vs. without cardiac damage |
| Cardiac parameters |
| IVSD [mm] | 8.5 (8-10) | 11 (9.5-12) | 12 (11-14) | <0.001 | n.a. | n.a. |
| PWD [mm] | 8 (8-9) | 10 (9-11) | 11 (10-11) | <0.001 | n.a. | n.a. |
| LVM [g] | 124 (26.3) | 164 (37.2) | 222 (46.4) | <0.001 | n.a. | n.a. |
| LVMI [g/m2] | 67.3 (11.3) | 82.3 (13.5) | 110 (17.5) | <0.001 | n.a. | n.a. |
| LVEF [%] | 66.9 (4.95) | 64.5 (6.95) | 62.6 (6.59) | NS | n.a. | n.a. |
| LAV [mL] | 45 (40.1-51.9) | 58 (49.5-67.5) | 72 (61.5-89) | <0.001 | n.a. | n.a. |
| LAVI [mL/m2] | 25.2 (7.86) | 30.1 (6.17) | 37.0 (8.03) | 0.010 | n.a. | n.a. |
| IVRT [msec] | 78 (67.8-89) | 94 (86-106) | 92 (78-108) | <0.001 | n.a. | n.a. |
| E/A ratio [-] | 1.19 (0.86-1.30) | 0.98 (0.82-1.22) | 0.89 (0.71-1.18) | NS | n.a. | n.a. |
| DecT [msec] | 193 (37.6) | 203 (31.9) | 202 (46.4) | NS | n.a. | n.a. |
| E’ ivs [cm/sec] | 9.48 (2.34) | 8.30 (2.00) | 6.58 (1.56) | 0.02 | n.a. | n.a. |
| A’ ivs [cm/sec] | 9 (8-11) | 10 (9-11) | 10 (10-12) | NS | n.a. | n.a. |
| E’ lw [cm/sec] | 12.2 (2.97) | 11.4 (2.74) | 8.61 (2.45) | NS | n.a. | n.a. |
| A’ lw [cm/sec] | 9.16 (2.20) | 11.1 (2.65) | 11.7 (2.64) | 0.003 | n.a. | n.a. |
| E’ mean [cm/sec] | 10.7 (2.59) | 9.81 (2.13) | 7.59 (1.53) | NS | n.a. | n.a. |
| A’ mean [cm/sec] | 9.14 (1.76) | 10.4 (2.35) | 11.1 (1.91) | 0.02 | n.a. | n.a. |
| E/E’ ratio | 7.17 (6-8.02) | 8.17 (6.5-9.4) | 9.2 (8.4-10.6) | 0.02 | n.a. | n.a. |
| Retinal arteriolar parameters |
| RCF mean [AU] | 313 (102) | 325 (97.2) | 326 (115) | NS | NS | NS |
| RCF systolic[AU] | 394 (113) | 427 (102) | 423 (131) | NS | NS | NS |
| RCF diastolic[AU] | 261 (98.8) | 270 (95.7) | 274 (128) | NS | NS | NS |
| OD [µm] | 110 (11.6) | 109 (14.8) | 106 (10.3) | NS | NS | NS |
| LD [µm] | 83.8 (9.78) | 80.7 (8.12) | 77.0 (7.60) | NS | 0.02 | NS |
| WT [µm] | 13 (11.5-15.4) | 14 (10.8-17) | 14 (11.4-16.5) | NS | NS | NS |
| WLR [-] | 0.32 (0.10) | 0.36 (0.13) | 0.39 (0.14) | NS | NS | NS |
| WCSA [µm2] | 3933(3368-4965) | 4170(3060-5574) | 3946.6(3060-4622) | NS | NS | NS |

Data are presented as mean +/- standard deviation or median and interquartile range.

A- late diastolic velocity of mitral annulus displacement, A’ ivs/lw – septal/lateral late diastolic mitral annular velocity, DecT- deceleration time, E- early diastolic velocity of mitral annulus displacement, E’ivs/lw- septal/lateral early diastolic mitral annular velocity, HT- hypertensives, IVSD- intraventricular septum diameter, IVRT- isovolumetric relaxation time, LAV- left atrium volume, LAVI- left atrium volume index, LD- lumen diameter, LVEF- left ventricular ejection fraction, LVM- left ventricular mass, LVMI- left ventricular mass index, NT- normotensives, n.a.- not applicable, OD- outer dimeter, PWD- posterior wall diameter, RCF- retinal capillary blood flow, WCSA- wall cross sectional area, WLR- wall lumen ratio, WT- wall thickness