Hypertension and Left Ventricular Hypertrophy

Date: 9/12/99, from 08:30 to 10.00

Location: Robert Stolz B

Chairpersons:
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Doppler tissue imaging of systolic and diastolic wall motion to assess difference between long and short axis in hypertension
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Aim of our study was to evaluate left ventricular (LV) wall motion of long and short axes by pulsed Doppler Tissue Imaging (DTI) to clarify difference of LV systolic and diastolic function in arterial hypertension. Standard Doppler-echo and pulsed DTI of posterior wall in parasternal short-axis and in apical long-axis views were performed to 15 hypertensive patients and 12 normotensive subjects. Myocardial velocities and time intervals were calculated by DTI in both systole (systolic peak = Sm, pre-contraction time = PCTm, contraction time and diastole (Em and Am peaks, Em/Am ratio, deceleration time = DTm, relaxation time = RTm). The 2 groups were comparable for age, body mass index and heart rate. Both systolic and diastolic blood pressure were higher (p<0.001) in hypertensive patients. They also presented higher LV mass index and relative diastolic wall thickness (both p<0.0001) and lower midwall fractional shortening (p<0.01), without difference of shortening at endocardium. DTI showed significantly lower Sm peak and Em/Am and longer PCTm, DTm and RTm of either short and long axis of posterior wall in hypertensive patients than in controls. In hypertensive patients, Sm peak and peak Em/Am were lower and both RTm and PCTm longer (all p<0.01) in short than in long axis view. In the overall population, inverse relations of short-axis posterior PCTm and both relative diastolic wall thickness and midwall fractional shortening (both p<0.001) were found but no relation of DTI long-axis indexes were observed with standard echo indexes. In conclusion, LV wall motion of both short and longitudinal axes are impaired in arterial hypertension but the involvement of either systolic or diastolic indexes is greater for short-axis. In the overall population, short-axis systolic more than long-axis motion influences midwall mechanics.
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Diastolic function in systemic hypertension: which variables are really informative?

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In systemic hypertension (HT) left ventricular diastolic dysfunction is found earlier than the systolic, and it is important in the assessment of hypertensive cardiopathy (HTC). This study determined which diastolic parameters are affected in HT and, of them, which ones allow a better characterization of HTC.

11 normotensive (NT) and 45 hypertensive subjects (10 without HT and 35 with HTHV) left ventricular hypertrophy (LVH) were included. Data collected were: left ventricular mass index (LVM), transverse, longitudinal and anteroposterior diameters of the left atrium (TD, LD, AD), mitral flow: maximum velocity and integral of the E (Ev), A (Av) waves, their ratio (Ev/Av, A/Av), acceleration and deceleration time of the E wave (Eat, Ead), deceleration time of the A wave (Ad), isovolumic relaxation time (IVRTv), half time pressure (HTP) and atrial contribution (AC); and pulmonary venous flow: maximum velocity and integral of the S (Sv), D (Dv) and A reversal (Apv, Api) waves, A wave duration (Apd), S and D waves ratio (Sv/Dv, Dv/Ad) and percentage of S (Sp), D (Dp) and A reversal (Ap) waves. Univariate and multivariate analysis were performed.

By univariate analysis LVM, TD, LD, AD, Av, Ev, A, Ev/Av, Ev/Ad, Ad, Eat, Ca, TRIV, Apv, Apv and Rpv showed differences between both groups. PT. DA, IRTV, CA and Api were higher in HTHV than in NT. Ev/Av and Ad were higher in HTN than in HT. LD was bigger in HTHV than in HT. Eat was smaller in HT. By multivariate discriminant analysis three discriminatory variables were obtained, LD, Ev/Av and Ev/Ad in two functions, (0.47xTD-0.65xEv+0.625xApd) and (0.84xDL-0.51xEv-Arav/0.33xEvApd), and six centroids which discriminated the three groups well.

Group NT HT HTHV
Function 1 -1.453 -0.143 0.685
Function 2 0.200 -0.676 0.143

Conclusion: Ev/Av in mitral flow and A reversal wave duration in pulmonary veins flow are the two diastolic parameters that, together with left atrial diameter, give more information in the echocardiographic study of diastolic function in HT.

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Left and right ventricular diastolic filling in different patterns of left ventricular geometry in arterial hypertension

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The aim of the study was to evaluate left ventricular (LV), right ventricular (RV) diastolic function and systolic function in different patterns of LV geometry in arterial hypertension (AH). To achieve the aim 209 mild-to-severe hypertensive patients underwent Echo-Doppler study with standard echo-measurements. Mitral and tricuspid inflow, early to peak atrial velocity (E/A); E/A ratio, E-wave deceleration time (DTlv; DTtv) and isovolumic relaxation time (IVRTv), IVRTv were obtained. Based on LV mass index and relative wall thickness the patients were divided into: normal (14.8%); concentric hypertrophy (CH) -- 57.9%); eccentric hypertrophy (EH) -- 20.6% pts. Systolic performance was assessed. Results: The patients were comparable for age (45±18, 45±11, 51±10 years), LV diastolic diameter (49±6, 49±7, 47±4 mm) and LV mass (192±61, 200±57, 197±48 g).

As compared to NT: a) MBP (90±8.10, 102±11 and 124±14 mm Hg) and RPP (10133±1885 vs 11814±3434 and 15576±4322 mmHg*bpm) were increased not significantly in BL and significantly in EHT (p<0.01 vs NL); b) PSWS was increased (p<0.05) in EHT only (139±30, 142±25 and 178±45 Pa x 10-2 respectively); c) CSFV was comparable in the three groups (27±4, 25±7, 20±10 cm/s); d) CFR was decreased (3.4±0.67 vs 2.87±0.46 and 2.66±0.58; p<0.001) and MCR increased (0.82±0.22 vs 1.30±0.30 and 1.39±0.46 mmHg/cm-1; p<0.01) at similar extent in BL and EHT.

Conclusion: Our results indicate that CFR is reduced and MCR is increased not only in established but also in borderline hypertension. This finding further supports the hypothesis of early coronary vascular changes underlying coronary dysfunction in hypertension.

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Coronary reserve is already reduced and minimum coronary resistance increased in patients with borderline arterial hypertension

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In patients with established hypertension (EHT), with or without left ventricular hypertrophy (LVH), 6% impairment in coronary vasodilator capacity related to structural and functional changes in coronary microcirculation is well demonstrated. Aim of the study was to assess coronary flow reserve (CFR) and minimum coronary resistance (MCR) in subjects with borderline hypertension (BL) as compared to normotensive controls (NL) and without LVH. Methods: eleven NL, 11 BL and 16 EHT were selected according to the absence of angina, LVH, ECG evidence of ischemia (Holter monitoring and exercise test), and/or any myocardial or valvular disorder. Mean flow velocity in left anterior descending artery was monitored by TEE-Doppler at baseline (CFVB) and during maximal flow response to Adenosine (700 µg/Kg/5min, CPWA) with simultaneous monitoring of BP and HR. Peak systolic wall stress (PSWS) was assessed by M-mode echo.

Results: The study groups were comparable for age (45±18, 45±11, 51±10 years). LV diastolic diameter (49±6, 49±7, 47±4 mm) and LV mass (192±61, 200±57, 197±48 g). As compared to NL: a) MSCP (90±8.10, 102±11 and 124±14 mm Hg) and RPP (10133±1885 vs 11814±3434 and 15576±4322 mmHg*bpm) were increased not significantly in BL and significantly in EHT (p<0.01 vs NL); b) PSWS was increased (p<0.05) in EHT only (139±30, 142±25 and 178±45 Pa x 10-2 respectively); c) CFVB was comparable in the three groups (27±4, 25±7, 20±10 cm/s); d) CFR was decreased (3.4±0.67 vs 2.87±0.46 and 2.66±0.58; p<0.001) and MCR increased (0.82±0.22 vs 1.30±0.30 and 1.39±0.46 mmHg/cm-1; p<0.01) at similar extent in BL and EHT.

Conclusion: Our results indicate that CFR is reduced and MCR is increased not only in established but also in borderline hypertension. This finding further supports the hypothesis of early coronary vascular changes underlying coronary dysfunction in hypertension.

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Patterns of renal perfusion with microbubbles in patients with systemic hypertension

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Background. We have previously shown that renal perfusion is accurately assessed by microbubble contrast echocardiography (ICU) in normal human volunteers. However its utility for pts with systemic hypertension has not yet been evaluated. The aim of this study was to assess the reliability of ICU to identify the renal perfusion patterns in these pts, correlating it with the creatinine clearance.

Methods. In 37 pts with moderate to severe systemic hypertension the kidneys were imaged in longitudinal plane during continuous infusion (5m/min) of PESDA (sonicated mixture of 1 ml 20% serum albumin, 12 ml 5% dextrose and 8 ml decafluorobutane gas). Renal scan was made with Power Harmonic Imaging technology with intermittent (triggered 1:1 mode) cortical renal contrast pattern was visually assessed. An evident and homogeneous contrast enhancement of all cortex was considered the normal perfusion pattern. Heterogeneous contrast enhancement of the cortex (that was invariably thin) was defined as mild to moderate decreased perfusion, and absence of perfusion associated to the disappearance of renal perfusion structure was considered severe decreased perfusion. The creatinine clearance was used to define renal function: normal (>70 ml/min); mild to moderate dysfunction (30-70 ml/min); severe dysfunction (<30 ml/min).

Results. GROUP A: excellent concordance between renal function (normal - 10 pts, mild - 4 pts and severe - 11 pts) and perfusion pattern. Heterogeneous contrast enhancement of the cortex was invariably thin and the absence of perfusion was associated with the disappearance of renal perfusion pattern. GROUP B: satisfactory correlation was noted between function and perfusion disagreement in 217 pts with mild to moderate decreased perfusion, and absence of perfusion associated to the worsening of renal perfusion pattern. Heterogeneous contrast enhancement of the cortex was associated with absent or decreased perfusion in 52 pts.

Conclusions: ICU is a powerful method to assess the renal perfusion in pts with systemic hypertension.