자기공명영상과 심초음파를 이용한 좌심방 용적 변화에 따른 좌심실 이완기 기능의 평가

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Assessment of LV Diastolic Function Based on Differential LA Volume Change: a Combined MRI- Echocardiography Study

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1. Introduction

LA Changes in diastolic indexes during normal aging, including reduced early filling velocity (E), lengthened E decelerationtime (DT), augmented late filling (A), and prolonged isovolumic relaxation time (IVRT), have been attributed to slower left ventricular (LV) pressure (LVP) decay. Indeed, this constellation of findings is often referred to as the "abnormal relaxation" pattern. However, LV filling is determined by the atrioventricular pressure gradient, which depends on both LVP decline and left atrial (LA) pressure (LAP).

LA volume as a morphophysiologic expression of LV diastolic dysfunction and relation to cardiovascular risk burden. .LA attributes have been characterized as booster pump, reservoir, and conduit, yet characterization of their temporal occurrence or causal relationship to diastolic function has been lacking. The purpose of this study was to investigate temporal occurrence or causal relationship of differential LA functions and correlated with diastolic dysfunction based on Doppler echocardiography.

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2. Materials and Methods

Twelve controls and 28 patients with various HD (25: ischemic HD, 1: Hypertrophic CM and 3: restrictive CM) were prospectively included. (13: G I, 9: G II, 6: G III-IV diastolic dysfunction)(1) Patients with systolic dysfunction (EF<45%), significant valvular heart diseases, arrhythmia are excluded. All patients underwent complete cardiac MRI and concurrent Doppler echocardiography(DE).

Cardiac Echo(Acuson Sequoia; Acuson Mountain View, CA) and MRI by using a 1.5-T unit (Intera CV release 10; Philips Medical Systems, Best, Netherlands) equipped with a 5-element phased-array cardiac coil. Cine MRI (Sense factor = 1.5, Half scan (+), Scan time: 2-3 sec/slice, 256 x 256 matrix, 8 mm section thickness (6~15 slice), no gap, NEX = 1, FOV = 27 x 27 cm) using 4 chamber view were acquired with saturation-recovery steady-state free precession sequence (SR- SSFP).

The LA and LV endocardial contours were manually traced in each slice at each phase of the three-dimensional dataset and the corresponding segmental volumes were determined. The alteration of differential LA volumes was analyzed according to the DE-determined diastolic function. Differential LA volume were calculated using discrete data points along LA volume curve (Fig. 1).

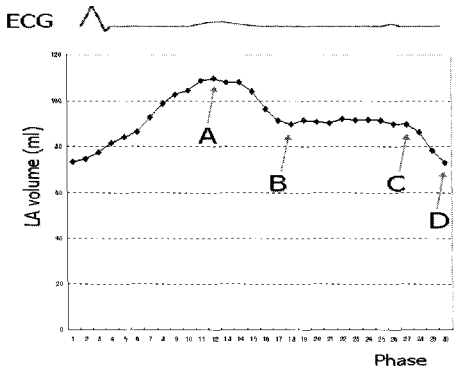

Fig 1. Typical plot of MRI-derived LA volume vs. time A: maximal LA volume, B: mid-diastolic relative minimal volume, C: LA volume immediate before atrial systole, D: minimal LA volume(2). *LA Reservoir Volume (LARV) = A-B, LA booster pump Volume (LABPV) = C-D, LA conduit volume (LACV) = LVSV - (LARV - LABPV), LACV(t) = [LV(t)-LVmin]-[LAmax-LA(t)]

3. Results

LV EF (57.7±12.1%: p=0.07) and stroke volume (79.1±22.4ml: p=0.55) was not significantly different between groups. The slope of LACV fill was correlated with Peak D velocity (R=0.55, P<0.001) and S/D ratio(R=-0.38, P=0.025) (Fig. 2). Ratio of LARV and LABPV was decreased in G I(0.68±0.21) and G II(0.71±0.15) and even increased in G III(2.37±1.23 vs. 1.30±0.58; p<0.001). Relative ratio of LACV to LVSV had inversely correlated with LARV(R=-0.33, P=0.04) and LABPV (R=-0.54, P<0.001) (Fig. 3).

4. Conclusion

There was reciprocal relationship between conduit and reservoir or pump function. As pump function decreases, the conduit function increases. The interplay of the 3 functions achieved a more contant SV, under the isolated diastolic dysfunction.

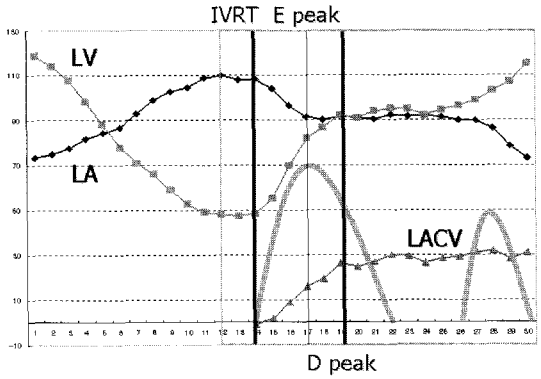

Fig. 2 Typical plot of MRI-derived LA volume combined with Doppler Echocardiography

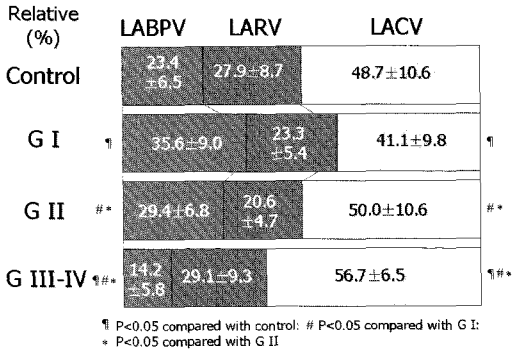

Fig. 3 Comparison of differential LV volume relative contribution to LVSV

참고 문헌

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