

Myocardial Blood Volume is Reduced in Hypertrophic Cardiomyopathy: A Study Using Myocardial Contrast Echocardiography

Hiroshi Komatsu¹, Satoshi Yamada¹, Masanao Naya¹, Takahiro Tsukamoto¹, Kaoru Komuro¹, Kazutomo Goto¹, Hisao Onozuka¹, Taisei Mikami², Nagara Tamaki¹

¹Hokkaido University Graduate School of Medicine, Sapporo, Japan

²Hokkaido University School of Medicine, Sapporo, Japan

Background: Myocardial blood flow (MBF) per unit myocardial volume is preserved normal at rest in patients with hypertrophic cardiomyopathy (HCM). A new technique to calibrate myocardial contrast intensity (CI) during myocardial contrast echocardiography (MCE) enables us to quantitate myocardial blood volume (MBV), an index of 'relative CI (RelCI)'. However, the alterations in MBV have not been evaluated in hypertrophied hearts. We thus measured both MBV and MBF in patients with HCM by using MCE and PET, respectively.

Methods: MCE was performed in 16 patients with HCM with asymmetric septal hypertrophy (H group) and 10 normal volunteers (N group). Apical 4-chamber view of harmonic power Doppler imaging was acquired at end-diastole of every 6 beats during continuous infusion of the contrast medium (Levovist, 2.5ml/min). RelCI in dB was calculated in 2 regions of septal and posterior segments by subtracting the CI of the intracavity blood pool adjacent to the segment from myocardial CI. In 9 of the 16 HCM patients MBF was measured at rest and during hyperemia induced by ATP in 2 regions by using ¹⁵O-water PET.

Results: Echocardiographic wall thickness of septum and posterior wall in H group were 19±4 and 10±1 mm, respectively. RelCI in the septum (mean±SD) was significantly lower in H group than in N group (-17.5±1.7 vs -15.7±1.5 dB, p<0.05), whereas that in the posterior wall did not differ between groups (-15.4±1.0 vs -16.6±1.9 dB). In contrast, MBF at rest was normal in H group both in septum (0.71±0.14 ml/min/g) and posterior wall (0.96±0.17 ml/min/g) (institutional normal values: 0.85±0.24 and 0.90±0.16 ml/min/g, respectively). However, MBF during hyperemia was significantly low both in the septum (1.37±0.45 ml/min/g) and the posterior wall (2.02±0.56 ml/min/g) (normal values: 3.82±1.37 and 3.90±1.17 ml/min/g, respectively). Among H group, RelCI was correlated with MBF during hyperemia (r=0.60, p<0.05).

Conclusions: MBV was decreased in the hypertrophied septum of HCM patients, which was correlated with the impairment of MBF increase during hyperemia. The reduction of MBV due to the structural changes of microvasculature might cause the functional abnormalities of microcirculation seen in hypertrophied hearts.

肥大型心筋症における心筋内血液量の低下:心筋コントラストエコー法を用いた研究

小松博史¹、山田 聡¹、納谷昌直¹、塚本隆裕¹、小室 薫¹、後藤数智¹、小野塚久夫¹、三神大世²、玉木長良³

¹北海道大学循環病態内科学, ²同医学部保健学科, ³同核医学講座

肥大型心筋症 (HCM) では安静時の分時心筋血流量 (MBF) は正常だが血流予備能 (MFR) は低下している. 心筋コントラストエコー法 (MCE) で, 左室内血液のコントラスト強度 (CI) を用いて心筋の CI を補正した relative CI (RelCI) を用いて HCM の心筋内血液量 (MBV) を検討した. 対象は非対

称性中隔肥大を呈する HCM 21 例と健常対照 13 例. レボピストの持続静注下に 6 心拍毎の間歇送信で四腔断面ハーモニックパワードプラ像を収集し, 中隔と後壁で $ReICI$ を求めた. 同部位で, 水 PET による安静時と反応性充血時の MBF を計測した. HCM 群の $ReICI$ は後壁では健常群と差がなかったが, 中隔では有意に低値であり, 肥大心筋での MBV の低下が示唆された. HCM 群では安静時 MBF は保たれていたが反応性充血時の MBF は健常群より低値で, MFR は低下していた. さらに, MFR と $ReICI$ との間に有意な正相間を認めた. HCM の肥大した中隔では MBV が低下している.

質疑応答

1-Q: HCM における血流予備能低下の機序は?

1-A: 今回の検討で, HCM の肥大心では血液量(血管容積)分画は低下していたが, 安静時の MBF は保たれていた. 安静時から抵抗血管が拡張して MBF を保つ機序が働いており, このため血流予備能が低下するものと考え.

2-Q: $ReICI$ の dB 値は何を意味するのか?

2-A: $ReICI$ は左室内血液に対する心筋の気泡密度の比を表し, 単位体積あたりの MBV を反映する. $ReICI$ が $-15dB$ であれば, 理論的には MBV は心筋 100 mL あたり 3.2 mL となる.