
Postoperative cardiac function was estimated by changes of DPI under exercise in patients treated with mitral valve replacement at Heart Institute Japan. DPI are composed of 3 main isocount contours, i.e., hyper, moderate, and hypoperfusion area. Marked changes of hyper and/or moderate area are expressed as significant changes. DPI at rest are divided into normal, slightly abnormal and abnormal according to hyper area. Master-single exercise was loaded on patients. Patients without symptoms after exercise were subdivided into 6 classes according to DPI at rest and changes of DPI. Note that the cardiac functional class I of NYHA were further classified objectively, non-invasively, easy, without risk into 6 classes. To study the pathophysiological meaning and utility of stress-DPI further follow-up study were performed.


In 54 patients with various heart diseases, pulmonary blood volume (PBV) was measured from the technique of RI angiocardiography with Tc-99m-PFP. PBV was calculated from the product of pulmonary mean transit time (PMTT) and pulmonary blood flow (PBF). PMTT was calculated from the difference of mean transit time with left atrium and pulmonary artery. PBV was calculated by RCG and total blood volume (TBV) measured with RISA. PBV in mitral valve disease (504±155ml/m²) was significantly increased than that of normal controls (259±105ml/m²), ischemic heart disease (283±58ml/m²) and cardiomyopathy (342±153ml/m²). In mitral valve disease, PBV was compared with cardiac catheterisation data, mean pulmonary wedge pressure (Pwp), mean pulmonary artery pressure (Ppa), mean pulmonary distending pressure (Pd) and pulmonary arteriolar resistance (PAR) respectively. There was no correlation between PBV and Ppw, Ppa and Pd, and correlation in all patients were 250 dyn/sec/cm². Correlation between PBV and PAR was 0.363, and PBV and TBV was 0.434. PBV was supposed to be computed by pulmonary vascular resistance and pulmonary artery pressure. However, in this experiments, significant correlation could not be obtained between them.


To detect noninvasively the redistribution of pulmonary blood flow, changes of DPI, caused under various stress, two injection methods were introduced. For control DPI before exercise 15mCi Tc-99m MAA was injected and then data were collected during 225 seconds period of quiet breathing. After the stress test 15mCi Tc-99m MAA was injected and then data were collected during 15 seconds. By comparing both DPI changes of DPI were evaluated, i.e., changes of DPI were tentatively defined as the 10% or more changes of hyper and/or moderate perfusion area and changes of DPI were studied in 50 cases. The whole process is stress-DPI. Although it represents the same distribution of pulmonary blood flow, changes of lateral DPI were often noted without accompanying changes of anterior-posterior DPI (34/50=68%), i.e., lateral-DPI was sensitive to detect changes of DPI. Theoretical consideration about this sensitivity of lateral DPI were discussed and new concepts, positive and negative volume effects, were introduced. Accuracy of 2nd DPI were theoretically considered and it is concluded that the changes of DPI are detected qualitatively without errors. Pathophysiological relationship between stress-DPI and Frank-Starling mechanism are also discussed.