

## Phase changes caused by hyperventilation stress in spastic angina pectoris analyzed by first-pass radionuclide ventriculography

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To understand the effect of hyperventilation (HV) stress in patients with spastic angina, left ventricular (LV) contraction was analyzed by quantitative phase analysis.

The study was performed on 36 patients with spastic angina pectoris, including vasospastic angina pectoris (VspAP: 16 patients) and variant angina pectoris (VAP: 20 patients). First-pass radionuclide ventriculography (first-pass RNV) was performed at rest and after HV stress, and standard deviation of the LV phase distribution (SD) was analyzed.

The SD was lower in patients with VspAP than in VAP ( $12.8 \pm 1.4$  degrees vs.  $14.6 \pm 2.2$  degrees,  $p < 0.005$ ) at rest. After HV stress, the SD (HVSD) tended to increase in VspAP patients (62.5%), whereas the SD decreased in VAP patients (70%). Due to HV stress, the percentage change in SD (%SD) in VspAP patients was  $8.9 \pm 23.7\%$  whereas that in VAP patients was  $-9.1 \pm 17.3\%$  ( $p < 0.01$ ). Moreover, phase histograms were divided into HVSD increase and HVSD decrease groups. The HVSD increase group had a decrease of HVEF, but the HVSD decrease group tended to have more decreased HVEF than the HVSD increase group.

These results indicate that spastic angina pectoris patients show various responses to HV stress. The HVSD increase group might have additional myocardial ischemia due to regional coronary spasm. In contrast, in the HVSD decrease group severe LV dysfunction or diffuse wall motion abnormality might have been generated, and this caused a reduction in the SD value. Phase analysis would therefore add new information regarding electrocardiographically silent myocardial ischemia due to coronary spasm, and HV stress might increase sensitivity for the detection of abnormalities in quantitative phase analysis, especially in VspAP patients.

**Key words:** variant angina pectoris, vasospastic angina pectoris, phase analysis, radionuclide ventriculography and blood pool scintigraphy, hyperventilation stress test