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**Extent and distribution of the perfusion areas of the
coronary artery selected for bypass grafting:
Assessment by intraoperative myocardial contrast
echocardiography**

To the Editor:

Preliminary experience with intraoperative use of myocardial contrast echocardiography demonstrated that this method had allowed direct real-time evaluation of the magnitude and geometry of regional myocardial perfusion of the native coronary artery selected for bypass grafting.^{1,2} We thus performed myocardial contrast echocardiography to evaluate the effec-

tiveness of myocardial revascularization during operations.^{3,4} The following case study demonstrated that intraoperative myocardial contrast echocardiography could be useful for intraoperative evaluation of the effectiveness of the surgical procedure and concomitant intraoperative decision making.

A 55-year-old man with a history of an inferior wall myocardial infarction was admitted with increasingly severe retrosternal chest pain. Coronary arteriography revealed significant two-vessel disease, including a 100% stenosis of the proximal left anterior descending coronary artery (LAD) with good collaterals from the conus branch of the right coronary artery (RCA) and a 99% stenosis of the mid-RCA (Fig. 1). The patient underwent bypass grafting for these vessels with saphenous vein grafts 1 week after coronary arteriography. A 1.5 mm probe passed distally in the LAD. After termination of cardiopulmonary bypass, myocardial contrast echocardiography was per-

Fig. 1. Preoperative coronary arteriogram revealed total occlusion of proximal LAD with good collateral circulation from RCA.

Fig. 2. The perfusion area of LAD was limited to anteroapical region through transesophageal echocardiography.

Fig. 3. Extents and distributions of perfusion areas of coronary arteries selected for bypass grafting. PL, Posterolateral; OM, obtuse marginal; Dx, diagonal.

Fig. 4. A, Postoperative coronary arteriogram revealed the obstruction of the mid-LAD and successful grafting with a Y-shaped saphenous vein graft to both sides of the obstruction. B, The perfusion area of the Y-shaped graft included the antero-septal and anterior regions of the left ventricle through transthoracic echocardiography.

formed by a bolus injection of sonicated 5% human albumin into each saphenous vein graft. Transesophageal echocardiography (model 65A ultrasound system, Toshiba Corporation, Tokyo, Japan) was used with a 5.0 MHz transducer by imaging a cross-sectional view obtained at the papillary muscle level of the left ventricle. The perfusion area of the RCA included the inferoseptal and inferior walls. The perfusion area of the LAD was limited to the antero-septal region, and its extent, which was expressed by means of the ratio of the circumference between enhanced borders to a full circle, was only 7.2% (Fig. 2), although we had estimated from the preoperative coronary arteriogram that the LAD would perfuse the antero-septal and anterior regions (Fig. 3).⁴ Accordingly, we decided that it was necessary to secure additional blood flow to the distal LAD with a saphenous vein graft. The proximal site was anastomosed to the former saphenous vein graft (Y-shaped graft). Postoperative coronary arteriography revealed obstruction of the mid-LAD (which had not been detected before the operation and may have been induced by insertion of the probe), as well as the successful grafting of the Y-shaped saphenous vein graft to both sides of the obstruction (Fig. 4). The perfusion area of this Y-shaped graft was the antero-septal and anterior regions of the left ventricle, as determined by transthoracic echocardiography (model 65A ultrasound system, Toshiba Corporation, Tokyo, Japan) (Fig. 4).

To evaluate the effectiveness of myocardial revascularization, one must grasp the geometry of graft perfusion during the operation. Intraoperative myocardial contrast echocardiography provides immediate information concerning the extent and distribution of the native coronary artery selected for grafting, with no risk. We assessed the extent and distribution of the perfusion area of the 69 coronary arteries (LAD, 19; diagonal branch, 10; obtuse marginal branch, 8; posterolateral branch, 14; RCA, 18) selected for individual bypass grafting on a cross-sectional view obtained at the papillary muscle level of the left ventricle (Fig. 3). The distribution of regional myocardial per-

fusion was defined from the area of myocardium enhanced by the contrast agent, and the extent of the area of revascularized myocardium was quantified by means of the ratio of its circumference between the enhanced borders to a full circle depicted on the cross-sectional view of the left ventricle. In this case, the geometry of graft perfusion to the RCA was appropriate. However, that to the LAD was small and encompassed only the antero-septal wall, which indicated that only septal branches were revascularized. Accordingly, we decided that this graft was inappropriate and we regrafted to the LAD, achieving good results.

We think we could estimate the extent and distribution of revascularized myocardium before the operation by comparing the aforementioned results and the findings of the preoperative coronary arteriogram. Such conjecture would be of some help in deciding surgical indications for myocardial revascularization. However, individual architecture of the coronary artery is not always the same and precise assessment is difficult.

Moreover, in this analysis of regional perfusion used cross-sectional views obtained at the papillary muscle, which is the most commonly recorded view. Therefore the perfusion area throughout the whole left ventricle may not be reflected. In the future, we plan to use echo views from all angles in making our assessment.

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