Letter to the Editor

Is intraoperative measurement of coronary blood flow a good predictor of graft patency?

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We read with interest Hirotani et al. manuscript [1] about intraoperative graft patency verification using transit time flow measurement (TTFM). The authors report their results with intraoperative TTFMs and postoperative angiography concluding that intraoperative coronary bypass flow is not, per se, a good predictor of graft stenosis.

We have been using TTFM technology since 1996 [2] to evaluate graft patency in more than 1200 patients. In our opinion strict protocols should be followed to correctly interpret TTFM findings.

1. Measurements should always be done with and without proximal occlusion of the revascularized coronary artery to detect any stenosis localized at the toe of the anastomosis and to exclude flow competition from the native vessel [2]. High level of retrograde blood flow may exist in spite of stenosis at the toe of the anastomosis; in this case drastic reduction in absolute flow is observed after proximal snaring of the coronary artery [2]. On the contrary, low flow status may be detected in perfectly patent anastomoses, whenever competition is present from less than critically stenosed coronary arteries. In this case, after placement of proximal snare, an increase in absolute graft flow can be observed [2].

2. Graft patency evaluation on the only basis of absolute flow value should be discouraged. Blood flow is directly proportional to blood pressure and inversely proportional to vascular resistance ($Q = P/R$, $Q =$ Blood flow, $P =$ Blood pressure, $R =$ vascular resistance). Vascular resistance is the real limit to blood flow and is dependent on many variables including blood viscosity, length of the vascular conduits, and the fourth power of the vessel’s radius ($R = 8 \eta L / \pi r^4$, $R =$ vascular resistance, $\eta =$ blood viscosity, $L =$ conduit length, $r =$ vessel’s radius). For this reason, absolute blood flow is not a good predictor of anastomotic quality because high vascular resistances may exist in spite of fully patent anastomoses.

3. To correctly address TTFM findings, flow curves, pulsatile index (PI) and mean flow values should be evaluated simultaneously. The curves are coupled with the EKG tracing to correctly differentiate systolic from the diastolic flow. In a patent coronary graft, the hemodynamics are similar to those physiologically observed in the coronary circulation: blood flows mainly during diastole with minimal systolic peaks taking place during the isovolumetric ventricular contraction (QRS complex).

The PI, expressed as an absolute number, is a good indicator of the flow pattern and, consequently, of the quality of the anastomosis. This number is obtained by dividing the difference between the maximum and the minimum flow by the value of the mean flow. In our experience, the PI should be between 1 and 5. The possibility of a technical error in the anastomosis increases for higher PI values [2,3].

In conclusion we agree that mean graft flow, being very dependent by the quality of the revascularized coronary artery, is not per se a good indicator of the quality of the anastomosis. On the contrary, TTFM technology may be very useful if mean flow values are interpreted together with TTF curves and PI values. Although there is still necessity to define the sensitivity of TTFM in detecting less then critical stenosis, correct and simultaneous interpretation of flow curves, mean flows, and PI values is crucial to reduce the number of undetected technical errors.

References
