EDITORIAL COMMENT
Viability, Prognosis, Revascularization, and Pascal*

David S. Bach, MD, FACC
Ann Arbor, Michigan

The presence and severity of ischemic left ventricular (LV) systolic dysfunction is an important predictor of prognosis. There are ample data demonstrating that for patients with coronary artery disease and ischemic LV dysfunction, revascularization is associated with a better prognosis compared with medical therapy alone. In addition, varying degrees of recovery of LV dysfunction can be observed after revascularization. To predict which patients will benefit most from surgical revascularization (and possibly which patients may not benefit at all), attempts have been made to prospectively assess the extent of myocardium that is dysfunctional but viable. However, the published literature on testing for myocardial viability is complicated, with conclusions that are sometimes contradictory. To a large degree, this is due to the disparate clinical scenarios in which myocardial viability is evaluated, the different noninvasive techniques used for its assessment, the vagaries of revascularization, and the variety of outcomes measured.

See page 2099

What is viable myocardium? The word “viable” implies that something is living or capable of germination. However, the term has been employed with varying meanings in the context of ischemic heart disease. Myocardium that is normally perfused and has normal contractile function is obviously alive. Myocardial viability is typically questioned in the setting of ischemic dysfunction, which occurs in two settings: “stunning” is transient myocardial dysfunction that complicates an acute cardiac event, whereas “hibernation” is mechanical dysfunction that occurs because of ongoing severe, chronic ischemia (1). Although it is probably easier to detect than hibernating myocardium, stunned myocardium recovers with the passage of time, and its identification is therefore of relatively less importance. In contrast, hibernating myocardium will not recover function without relief of ischemia, typically with revascularization. Its detection relies on the demonstration of intact metabolism on positron emission tomography, preserved cell membrane integrity as a measure of cellular perfusion using nuclear scintigraphy (and perhaps someday with myocardial contrast echocardiography), or contractile reserve using inotrope stimulation and echocardiographic or magnetic resonance imaging.

Because hibernating myocardium is subtended by a critically stenosed coronary artery, tracer uptake may be abnormal, and demonstration of contractile reserve may be limited by a competing ischemic response. Demonstration of viability is further confounded by the heterogeneous nature of dysfunctional myocardium, often involving partial-thickness infarction in the same location (2).

Several “gold standards” have been used against which testing for viable myocardium is judged. Recovery of regional or global mechanical function after revascularization serves as an attractive end point. However, recovery of function is affected by other variables, including the extent of partial-thickness infarction, the adequacy of revascularization, intervening ischemic events between revascularization and follow-up imaging, and concomitant medical therapy. For these reasons, “viable” myocardium should never have been taken as synonymous with “capable of recovering mechanical function.” The strongest observations to support this view relate to the prognostic implications of revascularization independent of mechanical recovery.

Prognostic importance of viability. The existence of viable myocardium among patients with ischemic LV dysfunction is a blade that cuts both ways. Among patients who undergo revascularization, the presence of viable myocardium portends the potential for symptomatic improvement (3–5), recovery of mechanical function (5), and superior prognosis (5,6). However, among patients who do not undergo revascularization, viable myocardium is a marker for poor prognosis (7,8). It appears that viable myocardium is a boon if the patient undergoes revascularization and a bane if the patient does not.

In an earlier editorial in the Journal (9) that accompanied another study addressing myocardial viability testing and prognosis, the question was raised whether it could be justified to simply consider revascularization in all patients with coronary artery disease and ischemic LV dysfunction. However, the idea was doomed with perhaps the worst that medical literature has available: noting that supporting data are from nonrandomized studies in the surgical literature. However, the issue remains pertinent. Knowledge that patients with viable myocardium fare better after revascularization than do those without viable myocardium is not an argument to deny revascularization to patients without viable myocardium. With the vagaries of myocardial viability testing, what is the appropriate level of certainty that viable myocardium is absent?

In this issue of the Journal, Sawada et al. (10) address the incremental value of myocardial viability detected using low-dose dobutamine stress echocardiography on the prediction of prognosis five years after surgical revascularization. They found that prognosis after coronary bypass surgery is related to the presence and extent of viable myocardium, and that the data contributed by low-dose

*Editorials published in the Journal of the American College of Cardiology reflect the views of the authors and do not necessarily represent the views of JACC or the American College of Cardiology.

From the Department of Medicine, Division of Cardiology, University of Michigan, Ann Arbor, Michigan.
To read the natural text, please refer to the original document as it is not available here. This text is generated based on the provided metadata and may not accurately reflect the content of the image.
the respective roles of surgical and percutaneous techniques even as both continue to evolve. However, the detection of viability is not exact, and available tests are imperfect. Because coronary artery bypass surgery does not appear to adversely affect survival in the absence of viable myocardium, why not exclude patients who are at especially high risk for bypass surgery (16) and refer the rest for revascularization?

Because it is appropriate to weigh consequences in addition to probabilities, the risks of failing to intervene should be considered, realizing that testing for viability is imperfect. Among patients with severe LV systolic dysfunction and reasonable surgical targets who are not at excessive risk for surgical revascularization, the consequences of failing to intervene may outweigh the risks of intervention, even if testing fails to detect viable myocardium. Specifically, in the absence of a contraindication, it may be very reasonable to intervene regardless of the presence or absence of viability.

**Should we test for viability at all?** If patients undergo revascularization regardless of the results, there is little rationale for preoperative testing. Some patients will still fall into “gray” areas, with moderate or greater risk for surgery and arterial targets that are less than ideal. Among such patients, testing for myocardial viability provides useful data that could help sway decisions toward or away from intervention. However, among patients in whom risk is not excessive, it may be the most prudent option to perform revascularization without testing for viability. Although some patients benefit from intervention more than others do, the risks of not intervening mitigate against a more conservative strategy.

---

**REFERENCES**