Myectomy or Alcohol Septal Ablation
Surgery and Percutaneous Intervention Go Another Round*

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Since the development of alcohol septal ablation by Sigwart (1) and its increasing adoption, the treatment of symptomat-ic hypertrophic obstructive cardiomyopathy (HOCM) with myectomy versus alcohol septal ablation has generated a passion of debate and disagreement not often seen. Of course one contributor to the intensity of this controversy is that myectomy is done by surgeons, and ablation by interventional cardiologists: debaters accustomed to disagreeing over the best approach to coronary revascularization and other issues (2) such as valvular heart disease and the repair of septal defects. However, participants in the HOCM debate have substantial arguments to fuel their passion, and one important point of contention is the risk of late arrhythmic events occurring after alcohol ablation. Indeed, guidelines offered by the American College of Cardiology and the European Society of Cardiology (3) have noted with caution the enthusiastic adoption of alcohol septal ablation, which now outnumbers myectomy. Septal ablation, the argument goes, produces a myocardial scar in patients who already have an arrhythmogenic myocardial substrate, whereas myectomy does not.

It is worth noting that electrophysiology studies (4,5) after septal ablation have not indicated an increased arrhythmogenic substrate, but cases of ventricular tachycardia (6,7) and sudden death (8) occurring after septal ablation have been reported. The specter of re-entrant arrhythmias arising from the septal ablation scar is certainly a plausible concern. Arrhythmia and sudden cardiac death complicate hypertrophic cardiomyopathy with or without intervention. For patients with clinical markers of risk (9) for ventricular arrhythmias, an implanted defibrillator effectively reduces the risk (10).

An important contribution to the debate is the report of Valeti et al. (11) in this issue of the Journal. The investigators performed cardiac magnetic resonance imaging (CMR) before and after myectomy (n = 24) or alcohol septal ablation (n = 24). The findings in and of themselves are not surprising: with surgical myectomy, a discrete segment of resection was identified, with minimal to no CMR evidence of myocardial necrosis, whereas with alcohol ablation, delayed hyperenhancement denoting myocardial infarction was always seen. This was described as “a large transmural infarction, located more inferiorly in the basal septum than myectomy and usually extending into the right ventricular side of the septum at mid-ventricular level” (11).

The pattern of infarction seen by CMR after ablation makes sense if we imagine the effects of infusing alcohol into a septal branch of the proximal left coronary: the distribution of injury ought to conform to the more or less wedge-shaped distribution of the coronary branch. A wave front of profound microvascular obstruction results, with infarction of most of the tissue within this zone. We previously reported this phenomenon with serial CMR studies after alcohol septal ablation (12).

Both septal ablation and myectomy relieve left ventricular outflow tract (LVOT) obstruction. In the study in this issue of the Journal, as in other nonrandomized comparisons (13), myectomy patients were 12 to 13 years younger than septal ablation patients. Because of the very different ages at presentation for treatment, one must wonder whether the genotype-phenotype mix differs between the 2 groups. In comparing the 2 techniques, age, comorbidities, and genotype will affect outcomes. Other comparisons of surgical myectomy and alcohol septal ablation not controlled for age have indicated similar effects on the outflow tract gradient and on symptoms (14), but have indicated greater gains in maximal oxygen consumption during exercise testing (15) with myectomy. In 1 age-matched comparison (16), efficacy (including exercise capacity) was not different between the 2 groups, and in that comparison, septal ablation resulted in more heart block, whereas myectomy was associated with more aortic regurgitation. Without a randomized study, it is difficult to assign efficacy differences to the treatments themselves, but it is abundantly clear that the site and extent of myocardial change differ substantially between the 2 treatments. One need only to look at the electrocardiograms after treatment to see a difference.

Myectomy is performed through aortotomy while on cardiopulmonary bypass, with resection of septal myocardium to create a channel expanding the LVOT. The experienced Mayo surgeons relieved the LVOT obstruction.
in all cases; no patient required a permanent pacemaker, and
1 patient had a stroke 2 weeks after the operation. Left
bundle branch block is a frequent consequence of myec-
tomy. In contrast, right bundle branch block is a frequent
consequence of septal ablation (17), and complete heart
block occurs in some cases. Septal ablation is performed by
administering ethanol via a small inflated and occlusive
angioplasty balloon into 1 or more of the coronary branches
supplying the septum (18). Variability (19) in the location,
size, and distribution of the first septal branch of the left
anterior descending coronary artery adds a dimension of
complexity to this procedure; septal infarction by ethanol
may be transmural or may preferentially affect the right or
left endocardial surfaces of the septum. Before injecting
alcohol, the distribution of the selected branch can be
studied with echocardiography, while an echocardiographic
contrast agent is instilled through the balloon, allowing
confirmation that the region to be infarcted is indeed the
part of the septum that causes the left ventricular outflow
tract obstruction. This technique also avoids injecting alco-
hol into a septal branch supplying other parts of the heart,
either directly or via collaterals.

Some septal ablation patients had residual obstruction,
and it is an important finding that most of these had
nontransmural infarction of the right ventricular side of the
septum, sparing the more proximal basal septum. In theory,
echocardiography with contrast instillation into the selected
branch should show the distribution of the target vessel.
One wonders why, in some cases, was the goal of infarcting
the basal septum not achieved? For the cardiologist seeking
perfect results with alcohol septal ablation, these failures
may be instructive. A number of “failure modes” of contrast
echo-guided septal ablation can be postulated:

1. The branch or branches injected with alcohol did not
actually supply the most basal septum, although echo-
cardiography suggested otherwise. Blame echo “bloom-
ing” artifact, or inadequate contrast border definition
and spatial resolution.

2. Echocardiography showed sparing of the basal septum
by the contrast instillation, but alcohol injection was
performed anyway. It may have been impossible to
identify a branch supplying that territory. In our expe-
rience, frequently an accessory septal branch (from the
left main coronary, high intermediate branch, or diag-
onal branch) supplies the basal left side of the septum,
and concerted efforts to find and cannulate this branch
are rewarded by successful ablation of the basal septal
bulge. Although it may be tempting to ablate the largest
or easiest septal branch of the LAD, sometimes these
arteries supply the right ventricular side of the septum
(20) or other distant parts of the heart (21,22).

3. Echocardiography correctly showed contrast distribu-
tion to the basal septum, but alcohol injection in the
selected branch was ineffective at treating that particular
myocardial segment. Perhaps the different viscosities of
echocardiographic contrast versus absolute alcohol ex-
plain the difference in localization. Other percutaneous
approaches to septal ablation have been tried, including
arterial embolization with foam particles (23) and coils
(24); should we consider using a more viscous alcohol
gel?

How large an infarct should we create? One study (25)
suggested that a larger risk area defined by contrast echo-
cardiography predicts a greater risk of heart block and other
complications and that a smaller risk area predicts fewer
complications without sacrificing efficacy at relieving ob-
struction. On the other hand, a study (26) of predictors of
treatment failure with septal ablation found that higher
baseline gradient, fewer septal branches injected, lower peak
creatine kinase, and smaller risk area by contrast echocar-
diogram (and higher residual gradient in the catheterization
laboratory) all predicted incomplete relief of obstruction.
A small randomized study comparing low (1 to 2 ml) and
higher (2 to 4 ml) doses of ethanol found no safety nor
efficacy differences (27). Because continued regression of LV
hypertrophy, including in the septum, has been shown after
septal ablation (28), most experienced cardiologists have
adopted an approach to alcohol septal ablation relying
heavily on contrast echocardiography guidance for selection
of the most suitable branch and saturation of the target
myocardium with a low dose of slowly infused alcohol.

How should a prudent practitioner (or concerned patient)
choose a therapy today, in the absence of randomized
comparisons of myectomy with alcohol septal ablation?
Both are effective in most cases (29); crossovers and repeat
procedures do occur with either. Both have low but finite
risk, and if there is any difference in procedural mortality
between the 2 approaches, it is small. For old and very old
patients (30), the less invasive approach may be safer;
mortality in surgical series has been reported in the range of
1.5% (31) to 3.2% (32) and was associated with age and
female gender. Mortality in series of patients having alcohol
septal ablation was 1.2% (33) or 1.3% (34).

The specter of the arrhythmogenic scar deserves further
consideration. Until we have improved arrhythmia risk
detection tools, a cautious approach considers clinical risk
factors for ventricular arrhythmias and sudden cardiac
death; when these risk factors are present, defibrillator
implantation after septal ablation certainly is reasonable.
Speculation that myectomy spares the need for a defibrilla-
tor is intriguing, but when the stakes are so high, the value
of insurance (in the form of a defibrillator) is hard to
dismiss, no matter which other treatment has been applied.

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