Patients with symptoms caused by hypertrophic obstructive cardiomyopathy are treated with β-blockers, verapamil, and disopyramide. Novel drugs are under development. The minority of patients whose symptoms interfere substantially with lifestyle despite optimal pharmacological management may be offered septal reduction therapy with ablation or myectomy. Other mechanical therapies, including short AV delay pacing, mitral valve replacement, and percutaneous mitral valve repair, are used in some cases. Although opinions on the relative merits of septal ablation and myectomy differ, optimal recommendations can be made for individual patients based on patient characteristics and patient preference. Based on anecdotal experience, marked septal hypertrophy (≥30 mm or more) has been considered a factor that favors myectomy over ablation. Data supporting this impression have until now been lacking. At the other end of the septal thickness spectrum, the presence of only mild hypertrophy (≤1.5 mm or less) is considered to be a relative contraindication to both septal ablation and septal myectomy because of what is judged to be an enhanced risk of creating a ventricular septal defect.

How Thick Is Too Thick for Septal Ablation?

The American College of Cardiology Foundation/American Heart Association guidelines, published in 2011, state that “the effectiveness of alcohol septal ablation is uncertain in patients with HCM with marked (ie, ≥30 mm) septal hypertrophy, and therefore the procedure is generally discouraged in such patients.” The 2014 European Society of Cardiology guidelines state that “septal ablation may be less effective in...patients with very severe hypertrophy (≥30 mm), but systematic data are lacking.” Indeed, previous studies designed to assess predictors of success of septal ablation failed to demonstrate definitively that septal thickness is a determinant of success.

Chang et al reported their outcomes in the 173 of 286 septal ablation procedures for which 1-year follow-up was available. Success was defined as improvement in exercise duration and better than halving of the left ventricular outflow tract (LVOT) gradient ≥1 year after ablation and was achieved in 134 patients (77%). Mean preablation septal thickness by echocardiography was 20 mm in both success and failure groups. The sole preprocedure predictor of procedural success was LVOT gradient (less success in patients with higher gradients).

Faber et al performed septal ablation in 312 patients (excluding 25 patients in whom the procedure was aborted, in most cases because contrast echocardiography indicated perfusion of myocardium outside the target area). Hemodynamic success, defined as LVOT gradient <16 mm Hg at rest and <60 mm Hg with (unspecified) provocation 1 year after ablation, was achieved in 239 of the 299 patients (80%) for whom data were available. In this study, preablation echoangiographic septal thickness, which averaged 20 mm in successful and 22 mm in unsuccessful cases, was a predictor of success in univariable analysis. The sole preprocedure parameter that were predictive of procedural success were age (less success in younger patients) and baseline LVOT gradient (less success in patients with higher gradients). The authors conclude that “the hemodynamic result of septal ablation appeared to be less favorable in younger patients with very high baseline gradients and a markedly thickened septum,” but do not provide individual patient data.

Finally, Steggerda et al achieved success, defined as improvement in New York Heart Association class with LVOT gradient <20 mm Hg at rest and <50 mm Hg with Valsalva maneuver 4 months after ablation, in 76 of 113 patients (67%). Mean preablation septal thickness by echoangiography was 22 mm in both success and failure groups. The sole procedural predictor of success was LVOT gradient (again, less success in patients with higher gradients).

In this issue of Circulation: Cardiovascular Interventions, Lu et al performed both echoangiography and cardiac magnetic resonance imaging (MRI) before and echoangiography 6 months after ablation. Preablation LVOT gradient was ≥50 mm Hg at rest or with Valsalva maneuver in all patients. For 73 of 102 ablation procedures (72%), the LVOT gradient was at least 50% lower on the follow-up echoangiogram. Mean preablation echoangiographic septal thickness was 23 in the success and 28 in the failure groups (P<0.001). Curiously, although echoangiographic posterior wall thickness was also greater in the failure group (9 versus 11 mm, also P<0.001), left ventricular mass, assessed by MRI, did not differ between the groups. Combined preablation basal anterior and basal anteroseptal wall thickness as assessed by MRI was 47 mm in the success and 55 in the failure groups (P<0.001). There was no difference between the success and the failure groups in

See Article by Lu et al
age, preprocedural New York Heart Association class or resting LVOT gradient, amount of ethanol administered, or postprocedural cardiac enzyme levels.

A limitation of the present study, other than those acknowledged by the authors, is lack of standardization in performance of the Valsalva maneuver for LVOT gradient provocation. Another potential limitation, common to all studies of this type, is spontaneous variation in the magnitude of the gradient. The study of Lu et al demonstrates for the first time that septal thickness is indeed a predictor of the success of alcohol septal ablation.

### How Thin Is Too Thin for Septal Ablation (or Myectomy)?

The American College of Cardiology Foundation/American Heart Association guidelines state that a requirement for septal reduction therapy is the presence of “targeted anterior septal thickness sufficient to perform the procedure safely and effectively in the judgment of the individual operator,” and, more specifically, that, “because of the potential for creating a ventricular septal defect, septal ablation should not be performed if the target septal thickness is ≤15 mm.” The 2014 European Society of Cardiology guidelines state that “in general, the risk of ventriculo-septal defect following septal alcohol ablation and septal myectomy is higher in patients with mild hypertrophy (≤16 mm) at the point of the mitral leaflet–septal contact.”

Although the creation of a ventricular septal defect complicates 1% to 2% of septal myectomy procedures and, more rarely, septal ablation, I am not aware of any data relating the risk to preprocedural septal thickness. Thus, the recommendation to avoid septal reduction therapy of either type in patients with modest degrees of hypertrophy seems to be based on logic and, perhaps, anecdotal experience rather than published data. In some patients with this degree of hypertrophy, mitral valve replacement or repair is performed as an alternative to septal reduction therapy, whether or not intrinsic abnormalities of the mitral valve are identified although this practice has been challenged.

### Clinical Implications of the Current Study

Given the multitude of pre-, intra-, and postprocedural factors, including age, baseline LVOT gradient, coronary anatomy and pathoanatomy, immediate postablation gradient, and peak creatine kinase, that may influence the hemodynamic and clinical success of septal ablation, it is perhaps not surprising that it has been difficult to isolate baseline septal thickness as a predictor of success.

The current study thus advances our ability to predict success and, therefore, to select patients for alcohol septal ablation. For the echocardiographic septal thickness cutoff of 22.6 mm, the authors cite 90% sensitivity but only 51% specificity for predicting failure of septal ablation. Based on these figures, the positive predictive value of septal thickness >22.6 is merely 42%, limiting its usefulness for patient selection for septal ablation. For the MRI-based combined basal anterior and basal anteroseptal thickness cutoff of ≥51 mm, the authors report sensitivity and specificity of 86% and 77%, respectively, yielding positive predictive value 60% for failure of ablation in their (typical) patient population; thus, most septal ablation procedures would be unsuccessful. Although it is possible to perform septal myectomy after unsuccessful septal ablation (or, for that matter, septal ablation after failed septal myectomy), the incidence of complete heart block is high after the combination (little surprise, because ablation often causes right bundle branch block and myectomy left bundle branch block).

Implications of the study of Lu et al are thus that (1) MRI should be considered before septal ablation and (2) marked septal hypertrophy should indeed be a factor favoring septal myectomy over septal ablation (Table). Clinicians should also bear in mind that marked septal hypertrophy (≥30 mm), while a relative contraindication to septal ablation, is also an accepted risk factor for sudden cardiac death in patients with hypertrophic cardiomyopathy. The performance of septal reduction therapy with either ablation or surgery does not obviate the need for sudden cardiac death risk stratification.

### Disclosures

Dr Fifer is a consultant for MyoKardia and is a site principal investigator for a Gilead Sciences study.

### References


KEY WORDS: Editorials ◼ catheter ablation ◼ cardiomyopathy, hypertrophic ◼ obstructive ◼ heart septal defects, ventricular ◼ hypertrophy, left ventricular ◼ magnetic resonance imaging ◼ ventricular outflow obstruction ◼ ventricular septum
Through Thick and Thin: What Are the Septal Thickness Limits for Alcohol Septal Ablation?

Michael A. Fifer