Scientific letters

Alcohol Ablation in Hypertrophic Cardiomyopathy: Localization and Quantification of Target Septal Artery-dependent Myocardium With 3-Dimensional Echocardiography

Ablación con alcohol en miocardiopatía hipertrófica: localización y cuantificación con ecocardiografía 3D del miocardio dependiente de la septal diana

To the Editor,

Alcohol septal ablation (ASA) aims to reduce the subaortic gradient in patients with symptomatic hypertrophic obstructive cardiomyopathy using alcohol to induce septal necrosis.[1] Our aim was to describe the usefulness of 3-dimensional (3D) transthoracic echocardiography (TTE) with contrast in the localization and quantification of the extent of septal artery-dependent territory.

From 2012 onward, we prospectively enrolled 6 patients who then underwent ASA[2] (Table). One patient was excluded due to poor imaging quality. Prior to ASA, 2D and 3D TTE were performed (Vivid E9, G.E. Healthcare). Following balloon occlusion of the selected septal artery, 1 to 2 mL of angiographic contrast were injected, and 2D and 3D TTE were repeated. The selected septal artery-dependent region showed an increase in echographic signal (enhancement). After confirming the suitability of the septal artery, approximately 2 mL of alcohol were injected. A multislice short-axis apicobasal view on TTE was used to trace contrast distribution and calculate the volume of septal artery-dependent myocardium (Figure A). For each slice, the area of enhanced tissue was multiplied by slice thickness, and the sum of these products gave the volume of enhanced myocardium. This volume was multiplied by myocardial density (1.05 g/mL) to give the mass of enhanced myocardium. Immediate outcome and troponin I concentration at 24 hours were recorded.

In all 5 patients, enhancement was localized around the basal septum, with extension-to a greater or lesser degree-toward the superior or inferior septum. Extension toward the midline of the segments varied. Enhancement remained localized to the septum in 2 patients and tended to spread toward the inferior

Table
Variables of the 5 Patients Analyzed

Patient number	1	2	3	4	5
Baseline information					
Age, years/ sex	65/female	73/female	72/female	85/female	61/female
NYHA functional class	III	III	III	III	III-IV
Ejection fraction, %	63	64	85	67	80
Septal thickness, mm	16	21	21	16	27
LVOT gradient, mmHg	71	140	60	44	110
Mitral regurgitation, type	III	III	None	I	III-IV
Intraprocedural 3D TTE with contrast					
Contrast distribution in basal septum	Midline of anteroseptal and inferoseptal segments	Midline with inferoseptal spread	Midline with anteroseptal spread	Midline	Midline
Contrast distribution in midseptum	Midline with inferoseptal spread	Inferoseptal	Midline with anteroseptal spread	Midline	Inferoseptal
Contrast region corresponds to SAM?	Yes	Yes	Yes	Yes	Yes
Contrast localized distally?	No	No	No	No	No
Total ventricular mass, g	200.1	246.5	318.5	144.3	196.0
Contrast mass, g	15.6	28.0	16.4	14.0	26.9
Percentage of total ventricular mass, %	7.8	11.4	5.2	9.7	13.8
Intervention					
Septal artery	< 1.5 mm, medial, long	2 mm, proximal, long	1.7 mm, proximal	1.8 mm, proximal, long	< 1.5 mm, proximal, short
Alcohol, mL	2.0	2.0	2.5	2.0	3.0
Baseline gradient, mmHg	97	110	65	60	157
Gradient post-ASA/on discharge, mmHg	0/0	0/70	0/0	0/18 with Valsalva	51/63
Mitral regurgitation post-ASA/on discharge	Minimal/I	Minimal/I	None/None	None/I	II-III/I-II
Complications	None	None	None	PPM	None
Troponin I at 24h, ng/mL	33.7	36.9	18	33	89

3D, 3 -dimensional; AA, alcohol ablation; ASA, alcohol septal ablation; LVOT, left ventricular outflow tract; NYHA, New York Heart Association; PPM, permanent pacemaker; SAM, systolic anterior motion; TTE, transthoracic echocardiography.

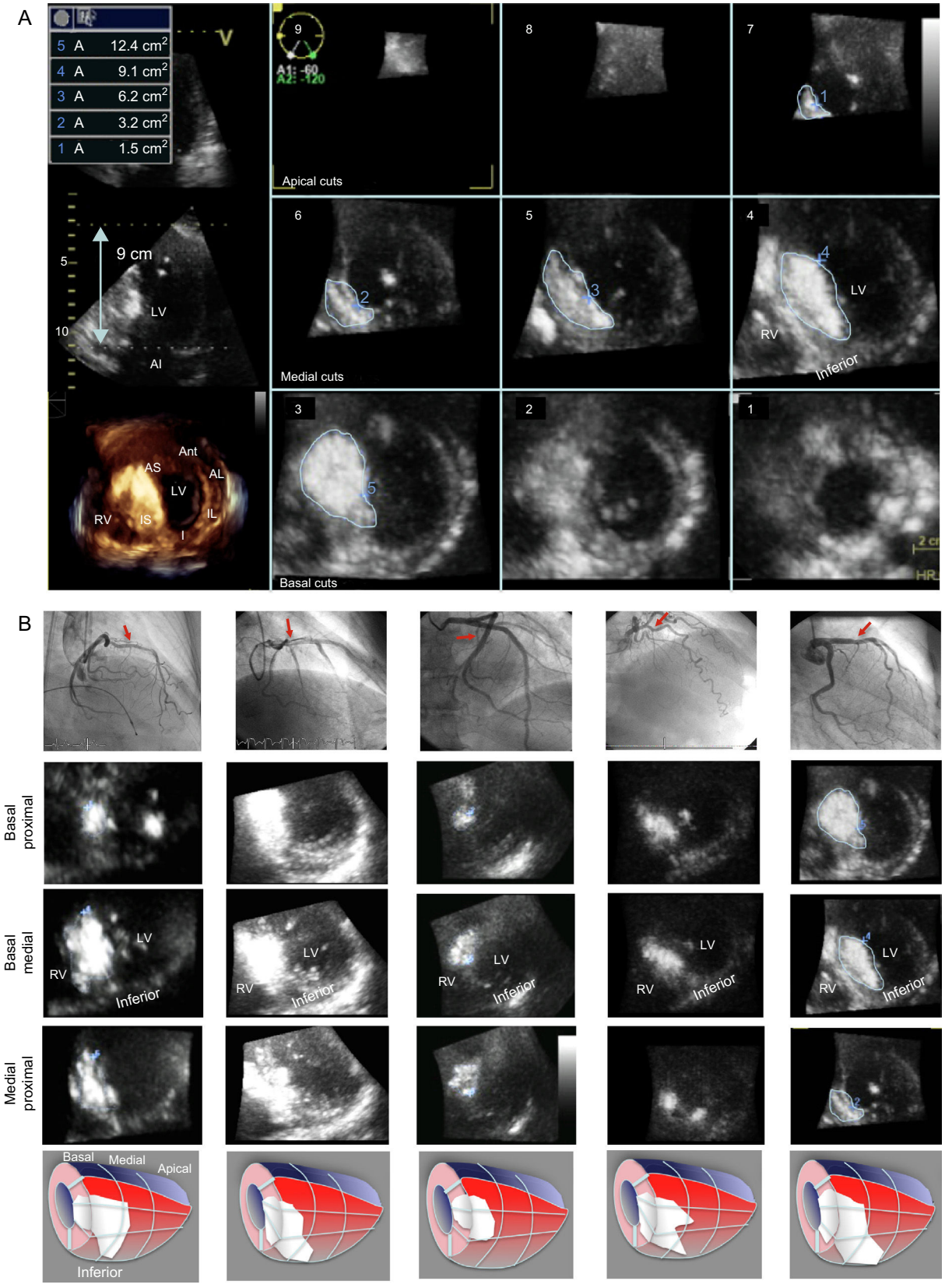

Figure. A: Three-dimensional multislice transthoracic echocardiography with contrast showing study of selected septal artery-dependent ventricular volume. Enhancement was distributed at the level of the basal septum and involved the inferoseptal and anteroseptal segments, extending to the midinferior septal segment. Calculated enhanced mass was 26.9 g, 13.8% of total myocardial mass. B: Graphic representation of the 5 patients: top, angiography with selected septal arteries (arrow); center, multislice 3-dimensional transthoracic echocardiography study with contrast showing the enhancement distribution in 3 basal and medial planes; bottom, representative diagram of contrast distribution in each patient (septal artery region in red and enhancement in white). LV, left ventricle; RV, right ventricle.

segment in the remaining 3. In all patients, enhancement was confirmed in the area of mitral valve contact with the septum. There was no spread to distal territories (Figure B). The septal artery-dependent myocardial mass was 20.21 g (range, 14.03 g-28.00 g), corresponding to 9.56% (5.2%-13.8%) of total myocardial mass. Troponin I concentration was 42.1 ± 27.2 ng/mL (range, 18-89 ng/mL).

In most patients, 3D TTE with contrast allowed precise localization and quantification of myocardial tissue dependent on the selected septal artery. It also allowed immediate confirmation of the real extent of contrast, whereas with 2D TTE with contrast, we cannot always be certain that all segments have been analyzed. In our cases, septal artery myocardial distribution appeared similar to necrosis distribution on post-ASA cardiac magnetic resonance (CMR). This distribution was noted predominantly at the junction of the anterior and inferior septa in the basal left ventricle and extended to the inferior portion of the midventricular septum.[2] Without the availability of CMR after ASA, this concordance could not have been validated. Furthermore, 3D TTE with contrast allowed quantification of the septal artery-dependent myocardial mass in a similar way to CMR study of necrotic mass. The value obtained for contrast mass (15.6 g-33.6 g) was similar to the necrotic mass values on post-ASA CMR published by Valeti et al[3] (16 g ±7 g with 1.7 mL ± 0.4 mL of alcohol) and Yuan et al[4] (27.9 g ± 13.1 g with 2.6 mL ± 1.3 mL). It is possible that the pre-ASA contrast study showed the entire septal artery-dependent vascular network, while post-ASA CMR showed only the necrotic area. There would undoubtedly have been dependent areas that did not necrose, and, in fact, as shown in the literature, necrosis also depends on the volume of alcohol injected.[3] Using 3D TTE with contrast, information can be obtained similar to that from CMR, but prior to ASA, allowing selection of the most appropriate septal artery branch and prediction of the subsequent infarct area. In addition, CMR is unsuitable for patients with pacemakers.

Three-dimensional TTE requires a machine with a 3D transthoracic probe. Image acquisition and intraprocedural analysis of the localization and extent of contrast with 3D TTE did not take longer than with 2D TTE. Quantification of the septal artery-dependent mass was done manually on an external work station and took approximately 15 to 20 minutes. Although this can be done during the procedure, it would be desirable to have a specific quantification program that reduced estimation time.

The main limitation of this study was the small sample size, due to the infrequency of ASA. This prevented us from establishing correlations between mass and enhancement and other variables.

In this study, we demonstrate the ease and usefulness of 3D TTE with contrast during ASA, as it allowed precise estimation of the target septal artery distribution and its dependent myocardial tissue size.

Further studies are needed to evaluate the potential usefulness of 3D TTE with contrast in selecting the target septal artery in complex cases with various possible branches, and in determining alcohol volume according to the dependent myocardial mass, which could reduce the need for permanent pacemakers.

José Luis Moya-Mur,* José Luis Mestre-Barcelo, Luisa Salido-Tahoces, Rocío Hinojar-Baydes, Rosana Hernández-Antolín, and José Luis Zamorano-Gómez

Servicio de Cardiología, Hospital Universitario Ramón y Cajal, Madrid, Spain

* Corresponding author:.
E-mail address: joseluis.moya@salud.madrid.org (J.L. Moya-Mur).

Available online 30 April 2015

REFERENCES

1. Hernández de la Torre JM, Masotti M, Lerena P, Sánchez A, Gimeno de Carlos F, Piñón P, et al. Eficacia y seguridad a más de 10 años de la ablación septal percutánea en la miocardiopatía hipertrófica obstructiva. Rev Esp Cardiol. 2014;67:353–8.
2. Moya-Mur JL, Salido-Tahoces L, Mestre-Barcelo JL, Fernández-Golfín C, Zamorano-Gómez JL. Three-dimensional contrast echocardiography-guided alcohol septal ablation in hypertrophic obstructive cardiomyopathy. Eur Heart J Cardiovasc Imaging. 2014;15:26.
3. Valeti US, Nishimura RA, Holmes DR, Araoz PA, Glockner JF, Breen JF, et al. Comparison of surgical septal myectomy and alcohol septal ablation with cardiac magnetic resonance imaging in patients with hypertrophic obstructive cardiomyopathy. J Am Coll Cardiol. 2007;49:350–7.
4. Yuan J, Qiao S, Zhang Y, You S, Duan F, Hu F, et al. Follow-up by cardiac magnetic resonance imaging in patients with hypertrophic cardiomyopathy who underwent percutaneous ventricular septal ablation. Am J Cardiol. 2010;106:1487–91.

http://dx.doi.org/10.1016/j.rec.2015.01.006

Acute Coronary Syndrome in Patients With Normal Coronary Arteries: An Optical Coherence Tomography Study

Síndrome coronario agudo en pacientes con arterias coronarias normales: estudio con tomografía de coherencia óptica

To the Editor,

Acute coronary syndrome (ACS) in patients with normal coronary arteries has a prevalence of between 8% and 25%.[1,2] Several mechanisms have been implicated in its etiopathogenesis, including coronary vasospasm, hypercoagulable states, and embolization.[2] Coronary angiography can assess the extent of stenosis but not the state of atheromatous plaques. The technique is therefore of limited use when complicated plaques are present, particularly in the absence of significant lesions.[3] Atherosclerotic plaques can, however, be characterized by optical coherence tomography (OCT).[2,3] Previous studies with this technique in ACS have focused on characterizing the substrates of angiographically

Table
Baseline Characteristics of the Study Patients

Demographic data and concurrent diseases	
Patients	21
Age, y	54.7 ± 14.79
Female	8 (38.1)
Hypertension	10 (47.6)
Diabetes mellitus	2 (9.5)
Dyslipidemia	11 (52.4)
Smoker	7 (33.3)
Exsmoker	5 (23.8)
Diagnosis on admission	
NSTEACS	14 (66.7)
STEACS	7 (33.3)
Coronary angiography findings	
LAD involvement	14 (66.7)
Cx involvement	4 (19.05)
RCA involvement	3 (14.3)