JACC: CARDIOVASCULAR IMAGING
VOL. 7, NO. 4, 2014

ISSN 1936-878X/$36.00
PUBLISHED BY ELSEVIER INC.
http://dx.doi.org/10.1016/j.jcmg.2014.01.010

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IMAGING VIGNETTE

LV Outflow Tract Area in Discrete Subaortic Stenosis and Hypertrophic Obstructive Cardiomyopathy

A Real-Time 3-Dimensional Transesophageal Echocardiography Study

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PRECISE ANATOMICAL ANALYSIS OF STENOTIC LESIONS OF THE LEFT VENTRICULAR outflow tract (LVOT) in discrete subaortic membranous stenosis (DSS) and hypertrophic obstructive cardiomyopathy (HOCM) is challenging due to their complex nature (1,2). In the present study, we clarified the difference of the geometry and dynamic change of LVOT area using en face views of the LVOT in 6 patients with DSS and 6 patients with HOCM by real-time 3-dimensional transesophageal echocardiography. There was a conspicuous difference in LVOT velocity (Fig. 1) and geometry between DSS and HOCM: the LVOT shape was almost oval or flat in DSS, whereas there was a V shape or 2 separate open spaces in HOCM (Figs. 2 and 3, Online Videos 1 and 2). The magnitude of area change of the LVOT was less in DSS than in HOCM. The LVOT area was minimal in late systole in both DSS and HOCM in spite of the presence of an early peak in LVOT flow velocities in DSS versus a late peak in HOCM (Fig. 4).

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Manuscript received January 3, 2014; revised manuscript received January 15, 2014, accepted January 17, 2014.

JACC: CARDIOVASCULAR IMAGING, VOL. 7, NO. 4, 2014
APRIL 2014:425–8

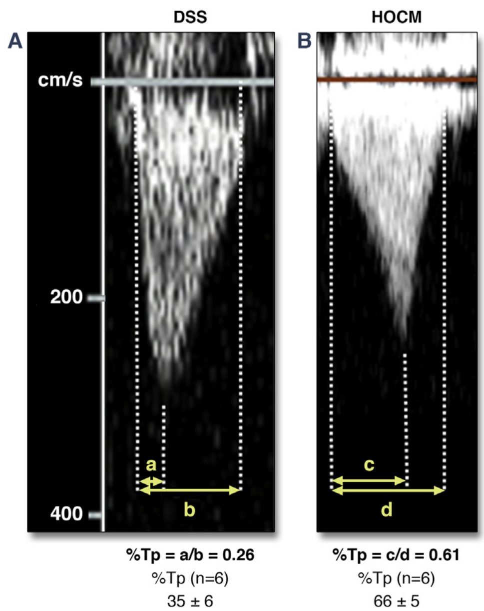

Figure 1. Continuous Wave Doppler Tracing of a Representative Case With DSS and HOCM Through the LVOT

Continuous wave Doppler tracing of a representative case with discrete subaortic membranous stenosis (DSS) **(A)** and hypertrophic obstructive cardiomyopathy (HOCM) **(B)**. We evaluated the timing of peak velocity in the left ventricular outflow tract (LVOT) Doppler tracing by measuring the percentage of time from the onset of systolic flow to peak velocity **(a and c)** out of the entire ejection time **(b and d)** (%Tp). In cases with DSS, continuous wave Doppler peaked in early systole **(A),** but in cases with HOCM, the peak was in late systole **(B)** (%Tp: 35 ± 6% in 6 patients with DSS vs. 67 ± 5% in 6 patients with HOCM).

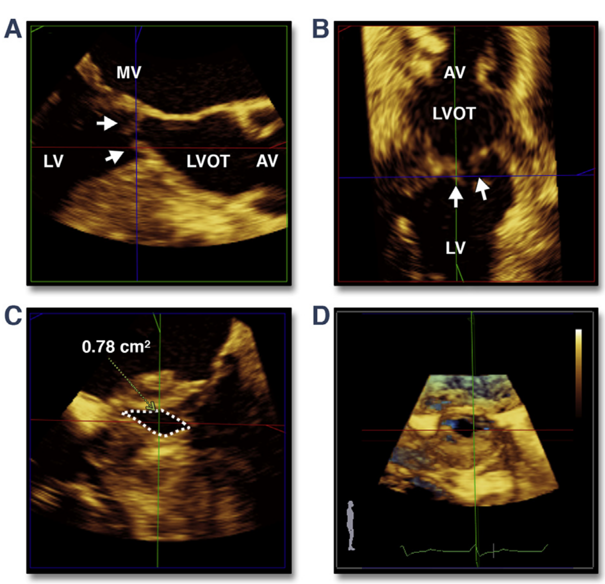

Figure 2. RT3D TEE Analysis of the LVOT Narrowed Area in Case With DSS

At first, 2 orthogonal long-axis planes of LVOT were extracted from the 3-dimensional (3D) datasets to be parallel to the LVOT **(A and B)**. A third plane perpendicular to both of the long-axis planes, a short-axis plane of the LVOT, was aligned. Fine adjustments of the cutting plane were performed to obtain the smallest cross-sectional area of the LVOT narrowed lesion. In this frame, we measured an LVOT narrowed area by manual planimetry **(C). Arrows** indicate the subaortic membrane. **(D)** Demonstrates a 3D image of LVOT. AV = aortic valve; LV = left ventricle; MV = mitral valve; RT = real time; TEE = transesophageal echocardiography; other abbreviations as in Figure 1.

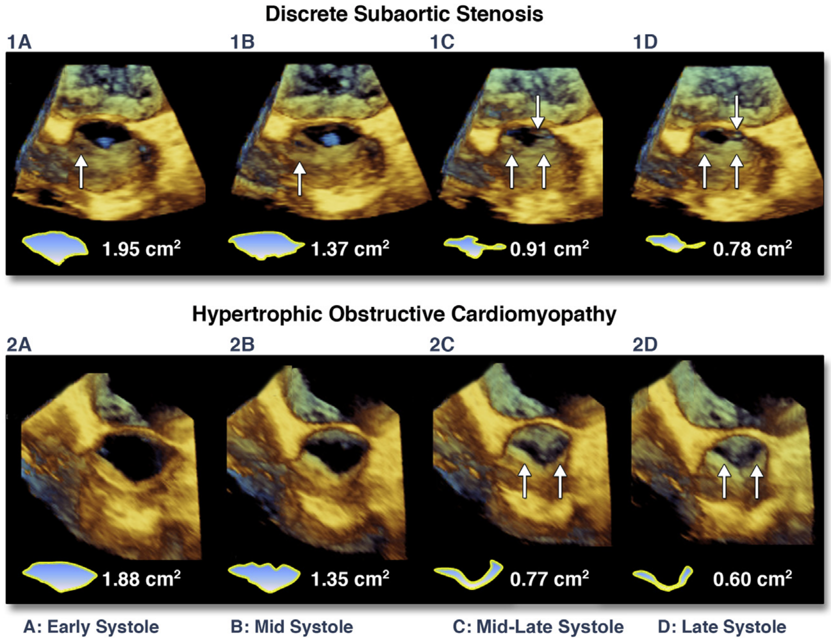

Figure 3. Geometry and Dynamic Change of LVOT Area in Systole in DSS and HOCM

Dynamic change of LVOT area in systolic phase using en face images of a representative case of DSS and HOCM. The DSS images show the almost oval or flat shape of the LVOT **(1D)** and subaortic membrane with small fenestration at the left upper site of membrane **(1A and 1B, arrow**, Online Video 1**)**. The thin membranous structure changes its angle to decrease the LVOT area along the blood stream **(1C and 1D, arrows**, Online Video 1**)**. In HOCM, the shape of the LVOT is a V formation or 2 separate open spaces due to systolic anterior motion of mitral anterior leaflet **(2C and 2D, arrows**, Online Video 2**)**. **2A** and **2B** show LVOT area in early to mid systole (Online Video 2). Abbreviations as in Figure 1.

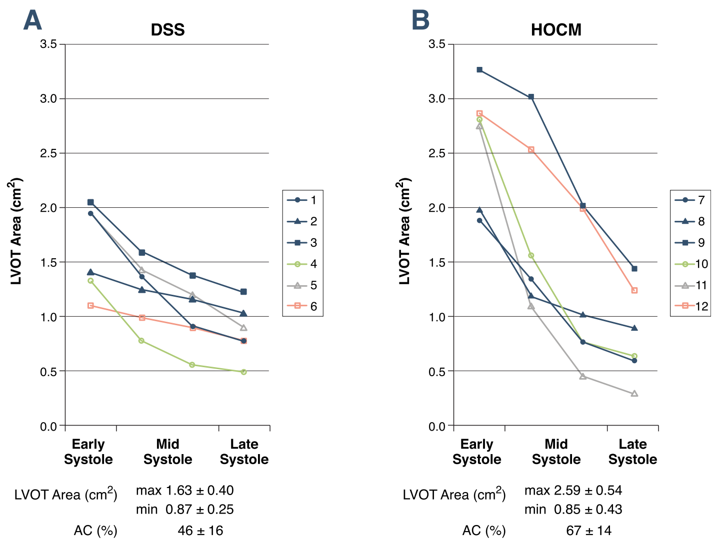

Figure 4. Temporal Change of LVOT Area in All Cases With DSS and HOCM

In both DSS **(A)** and HOCM **(B),** the LVOT area was the maximum in early systole (1.63 ± 0.40 cm^2 vs. 2.59 ± 0.54 cm^2), became smaller in systole, and was the minimum in late systole (0.87 ± 0.25 cm^2 vs. 0.85 ± 0.43 cm^2). We calculated the percentage of area change of the LVOT in systole (%AC) as: (1 – minimum LVOT area/maximum LVOT area) × 100. %AC was smaller in DSS than in HOCM (46 ± 16% vs. 67 ± 14%). Abbreviations as in Figure 1.

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Key Words: discrete subaortic stenosis ■ Doppler ■ echocardiography ■ left ventricular outflow tract obstruction ■ 3-dimensional.

APPENDIX

For supplementary videos and their legends, please see the online version of this article.