Standard Two Dimensional Echocardiography Underestimates the Left Ventricular Outflow Tract When Compared to Full Volume 3D Imaging

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Background: Using the continuity equation, 2D echocardiography can underestimate the aortic valve area (AVA), largely due to errors in measuring the left ventricular outflow tract (LVOT) area. Here we compare LVOT area measurements obtained by 3D echocardiography against the standard 2D measurement.

Methods: 73 patients undergoing both transesophageal (TEE) and transthoracic echocardiography (TTE) for clinical indications were analyzed. LVOT area was measured using 2D TTE, 2D TEE (assuming circular LVOT), and 3D TEE imaging (see Figure). LVOT eccentricity was measured by 3D TEE as the ratio of the short to long axis (values closer to 1 being more circular).

Results: LVOT area measured by 2D TTE and TEE were similar (3.3 ± 0.9 vs. 3.4 ± 0.9 cm², p = 0.28). 3D TEE LVOT area was larger compared to 2D TTE (3.3 ± 0.9 vs. 3.9 ± 0.9 cm²; mean difference 0.6 ± 0.7 cm²; p < 0.0001). Mean LVOT eccentricity was 0.86 ± 0.12. Mean AVA difference (between 2D TEE and 3D TEE using the continuity equation) was 0.40 ± 0.51 cm² (p < 0.01). Increasing patient age correlated with increased LVOT eccentricity (r = 0.24, p = 0.03).

Conclusion: 2D echocardiography underestimated LVOT area as compared to 3D TEE, which may lead to potential inaccurate assessment of AVA. LVOT eccentricity increased with age, making the LVOT measurement more problematic in the aortic stenosis population. This study suggests that patients with conflicting data on AVA and aortic stenosis severity may benefit from 3D evaluation of the LVOT.