in assessing endocarditis (IE)-related lesions, we performed 2DE (TTE and TEE) and 3DE in 35 pts with IE (aortic valve 18, mitral 12, tricuspid 3, pulmonic 1, VSD 1). Using multiplane TEE in 22 pts and rotational TTE approach in 10, volume-rendered dynamic 3DE projections were accomplished. 3DE data were compared to 2DE findings. *Results:* In the 35 pts, 2DE showed vegetations (V) in 33 pts while 3DE identified V in 30 pts. However, in demonstrating the number of V in the whole pt group, 3DE displayed 52 V while 2DE detected only 39 ($p < 0.01$). Among 39 V identified by 2DE, 3 small V could not be visualized by 3DE. The smallest V identified by 3DE was 3 × 2 mm in size. The precise site of attachment of V was better delineated by 3DE in all. Both 2DE and 3DE showed valvular perforations (P) in 8 pts. 3DE however displayed P sites and shapes better. The shape and extent of intervalvar aneurysm in 1 case was more clearly defined by 3DE. While a large para-aortic abscess was seen in 2DE images in 1 pt, 3DE demonstrated 4 abscesses (in aortic ring, interatrial septum, pericoronary artery area and one extending to the LA appendage). In 18 pts who had surgery, all 3DE findings were confirmed. We conclude that 3DE identifies the number of V more accurately, defines their attachment sites better, and yields enhanced display of the site and extent of perforations and abscesses; thus 3DE provides additional information on endocarditis-related lesions.

985-102 Does Color M-Mode Flow Propagation Differentiate Between Patients With Restrictive vs Constrictive Physiology?

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In order to evaluate whether color M-mode flow propagation (CFP) can be used in the differential diagnosis of patients with restrictive and constrictive physiology, we studied 14 patients, 7 with constrictive pericarditis and 7 with restrictive cardiomyopathy whose diagnosis were confirmed by TEE, MRI and/or surgery. Patients were imaged from the apical 4-chamber view and color M-mode of the mitral inflow obtained. Nyquist limit were set between 43 and 58 cm/s. CFP recordings were processed using a customized algorithm and the color velocities decoded. From the digital color velocity map we measured four parameters of flow propagation into the LV to evaluate the best discriminator between constrictive and restrictive physiology: a) Slope of the color-noncolor (CNC) transition; b) slope of the first aliasing contour; c) apical displacement of spatial peak velocity (AD); d) time delay of maximal velocities from the mitral valve to the apex (A-delay).

	CNC slope	1º Alias slope	AD (cm)	A-delay (s)
Restric	143 ± 74cm/s	54 ± 10cm/s‡	1.1 ± 0.4*	0.07 ± 0.03†
Constr	173 ± 83cm/s	167 ± 80cm/s	2.8 ± 0.8	0.02 ± 0.02

†p = 0.02; ‡p = 0.003; *p = 0.0005

Conclusions: i) The apical displacement of spatial peak velocity, the first aliasing slope and apical delay of maximal velocities are significantly different in constrictive vs restrictive patients. ii) Color M-mode flow propagation is a new technique that appears useful for differentiating patients with constrictive vs restrictive physiology.

985-103 Asynchrony of Left Ventricular Relaxation in Normal Volunteers: A Study Using High Frame Rate Echocardiography

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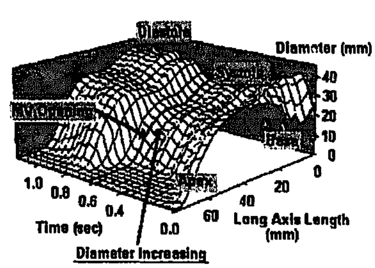
Intraventricular flow (ILVF) towards the left ventricular apex has been observed during isovolumic relaxation using color M-mode echocardiography. We hypothesized that ILVF is due to asynchronous early LV relaxation with secondary regional LV volume changes prior to mitral valve opening. We used high-frame-rate (113 fps) imaging to obtain apical four chamber views and color Doppler M-mode velocities in 12 normal volunteers aged 23 to 41 years. Regional volume changes were calculated using a computer-based



analysis applying Simpson's rule. *Results:* ILVF was apparent in 8 volunteers (F+ group) and was not observed in 4 residuals (F– group). In both groups, short axis apical diameters and long axis length increased 85 ± 20 msec prior to mitral valve opening. Volume changes of the LV apex (≥ 3 cm from the mitral ring) were greater than volume changes at the base (3.4 ± 0.54 vs 2.4 ± 1.0 ml, $p < 0.01$) only in F+. The change in volume of the apex was greater in F+ than in F– (43 ± 6 vs 28 ± 6 ml/sec, $p < 0.01$).

Conclusion: 1) Asynchrony of early LV relaxation was observed using high-frame rate imaging in normal subjects. 2) Regional LV volume changes were associated with ILVF by color Doppler M-mode. 3) These results suggest that heterogeneity of LV relaxation may be the cause of the previously documented intraventricular pressure gradients during early diastole.

985-104 Use of Three-Dimensional Reconstruction for Understanding and Quantifying Surface Adherent Regurgitant Jets: An In Vitro Study

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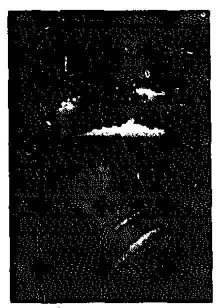
We used three-dimensional (3D) reconstruction for evaluating surface adherent jets imaged by color Doppler flow mapping. Steady flows (20–80 cc/sec) were driven through a circular orifice (0.11 mm^2) in an in vitro model. Free jets were imaged and for surface jets, a straight surface (height/width = 45 mm/20 mm) or a convex one was attached 0.1 cm from the regurgitant orifice. Jets were imaged using an Toshiba PowerVision SSA-380A with a 5 MHz transducer and rotationally acquired composite video regurgitant jet images were transferred into and reconstructed with a Tomtec computer. Volumes of 3D regurgitant jets were measured and were compared to actual flow rates measured with a graduated cylinder and a rotameter. The 3D reconstructions showed characteristically flattened and widened jet propagation for all surface jets (Figure).



A linear relationship between flow rates and 3D jet volumes was obtained for free, straight and curved surfaced jets (r = 0.91–0.95, $p < 0.001$). However, 3D jet volumes for flat surface jets were systematically smaller than those for free jets ($p < 0.001$), while for the convex surface, jet detachment from the distal surface yielded jet volumes in an intermediate range between the free and flat surface jets. Our study suggests that 3D methods should enhance approaches for quantifying regurgitant jets, especially for surface or wall adherent jets.

985-105 Improved Flow Rate Calculation by 3D Reconstruction of the Proximal Flow Convergence Field

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Flow rate calculation from proximal isovelocity surface area (PISA) analysis depends on geometric assumptions. To overcome this limitation, 3D reconstruction (TomTec) of color Doppler images from a multiplane transducer was used in a constant flow *in vitro* model at three different pressure gradients (55, 77, 101 mmHg) with six circular or slitlike orifices (0.1 to 1.0 cm^2). Three measurements were averaged for each setting.

Flow rate was calculated using three methods: (1) from aliasing velocity v and aliasing radius r by $2 \cdot \pi \cdot r^2 \cdot v$, (2) multiplying 3D-reconstructed PISA by v

Method of calculation	Percentage of true flow rate
1	58 ± 11%
2	65 ± 16%
3	76 ± 17%