analysed by 2 separate observers. TOE and RT-3DE images were acquired digitally on the Philips IE33 ultrasound machine and stored for off-line analysis. The RT-3DE datasets were analysed with Phillips Qlab software (version 4.0). Leaflet segments and commissures were displayed in short axis en-face and long axis views. Echocardiographic results were validated intraoperatively.

Results: Patients did not have image quality suitable for analysis with RT-3DE and were excluded from analysis. This left a sample size of 39 patients (mean age 52±11 years, 19 male). Twenty - five patients had mitral valve repair and 9 mitral valve replacement. In total, 54 out of 334 analysed mitral valve segments were diseased. Prolapse of a single mitral valve segment was present in 25 patients. 14 patients had complex disease involving 2 or more segments. Sensitivity, specificity and accuracy for TOE in identifi-
cation of diseased segments were 94%, 100% and 96% respectively. The same values for RT-3DE were 91%, 100%, 94%. The differences were not statistically significant. Accuracies were not significantly different according to segment location. Ruptured chordae was confirmed at surgery in 20 pa-
tients. Sensitivity for the diagnosis of ruptured chordae was 90% for TOE and 72% for RT-3DE (p=0.03). Specificity was comparable by both tech-
niques (89% TOE vs 83% RT-3DE). Interobserver agreement was 92% for
(TOE (k=0.85) and 86% for RT-3DE (k=0.83, p=non significant). The mean procedure time for TOE was 27±8 minutes. This was significantly longer than the procedure time for RT-3DE (7±3 minutes, p=0.03). The mean 3D reconstruction time was 15±2 minutes.

Conclusions: RT-3DE is feasible with comparative accuracy to TOE for pre-
clinical and anatomical localisation of prolapsing mitral valve segments. However, the technique is limited by poor image quality in a small proportion of pa-
tients. TOE remains superior for diagnosis and localisation of chordal rupture.

3-D ECHO

406 Volumetric Blood Flow Measurement by three-dimensional transoesophageal Doppler-echocardiography

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Background: Currently available non-invasive methods for quantification of cardiac output (CO) do not account for the three-dimensional velocity profile and are angle-dependent, thus providing inaccurate results. In collabora-
tion with TomTec Munich, we have developed a new software, which has the potential to overcome these limitations as it is angle-independent and allows assessment of velocity profiles by using three-dimensional colour-coded transoesophageal Doppler-echocardiography (3D-Doppler). We have validated CO as assessed by 3D-Doppler versus invasive measurements.

Methods: Twenty-one early postoperative cardiac surgical patients were included in the study. An ultrasound system (Sequoia, Acuson, CA) was used. To acquire 3D velocity distribution in the left ventricular inflow tract, the ultrasound probe rotated synchronous with the pulse in five degree steps by 180 degree around the axis of the ultrasound beam. The volume was reconstructed and displayed three-dimensionally from the obtained data (TomTec 4D Cardio scan) and the data were analysed offline (TomTec 4D Echo view). The results were compared with those obtained simultaneously by pulmonary artery thermodilution.

Results: Three patients could not be evaluated by echocardiography due to poor image quality because of postoperative air between the ultrasound probe and the inflow tract. In the remaining 18 patients, 5 had only sufficient image quality, 13 had moderate image quality, and 13 less than the open orifice. The recorded data was processed offline using Matlab for high-pass filtering, except the coaptation height (1.92±0.25 vs 1.58±0.34, p=0.0451). The differences were not statistically significant. Accuracies were not significantly different according to segment location. Ruptured chordae was confirmed at surgery in 20 pa-
tients. Sensitivity for the diagnosis of ruptured chordae was 90% for TOE and 72% for RT-3DE (p=0.03). Specificity was comparable by both tech-
niques (89% TOE vs 83% RT-3DE). Interobserver agreement was 92% for
(TOE (k=0.85) and 86% for RT-3DE (k=0.83, p=non significant). The mean procedure time for TOE was 27±8 minutes. This was significantly longer than the procedure time for RT-3DE (7±3 minutes, p=0.03). The mean 3D reconstruction time was 15±2 minutes.

Conclusions: RT-3DE is feasible with comparative accuracy to TOE for pre-
clinical and anatomical localisation of prolapsing mitral valve segments. However, the technique is limited by poor image quality in a small proportion of pa-
tients. TOE remains superior for diagnosis and localisation of chordal rupture.

408 Determining mitral regurgitant jet area using three dimensional color-flow

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The cross sectional area (CSA) of a regurgitant jet represents a quantitative measure of regurgitation severity. Although the PISA method may be used for this purpose, there are limitations regarding eccentric jets, multiple jets and jets with a complex geometry. Measuring the regurgitant CSA directly from 3D-color-flow images represents an alternative to the PISA method.

The CSA of the vena contracta region, the region with near-laminar flow just below orifice, has previously been shown to correlate well with the actual orifice area. Using a GE Vivid 7 ultrasound scanner and a matrix array probe we measured the CSA of the vena contracta region in 2 patients with mitral regurgitation and in a phantom with a circular orifice. The 4D colorflow data was acquired over 6 heart cycles, and stitched to gether to form a full volume based on ECG triggering.

The phantom uses a steady-state flow of a blood-mimicking fluid and it uses orifices with arbitrary size and geometry. For this study we used three circu-
tor orifices with area 0.13, 0.28 and 0.58 cm2 and a pressure-gradient giving a jet velocity of 4 m/s. The vena contracta region was found using high pulse repetition frequency (HPBF) PW Doppler by manually searching for a region with maximum velocity and minimum bandwidth. A “banana-shaped” orifice with cross sectional area of 0.39 cm2 was also used to evaluate the perfor-
man method of the software for a more clinically realistic shape.

The recorded data was processed offline using Matlab for high-pass filtering and calculation of power doppler images. The images were visualized using View, and the diameter of the vena contracta region below the orifice was measured. Preliminary results from the circular orifice with area 0.39 cm2 was found to have a circular vena contracta with CSA of 0.36 cm2. The vena contracta region is known to be more eccentric than the orifice. Some examples of in-vivo 3D-color-flow images of mitral regurgitation and corresponding cross sectional areas will be presented, as well as images obtained in vitro using the banana-shaped and circular orifices.

Measuring the cross sectional area of the regurgitant jets directly using 3D ultra-
sound does not have the limitations of the PISA method when it comes to jet location and geometry. We have shown that using a recent ultrasound scan-
er with 4D color doppler capabilities the CSA of an in vitro severe regurgi-
tation can be measured directly in the vena contracta region.

409 Mechanism of residual regurgitation following a mitral valve repair. A three-dimensional echocardiographic study

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Background: 3D echocardiography extends the scope of 2D echocardiography and enables to evaluate anatomy of complex cardiac structures, i.e. congenital abnormalities, venicular septal defects or native mitral valve. The aim of this work was determine the mechanism of late failure of mitral valve repair using transesophageal 3D echocardiography.

Methods and results: Seventeen consecutive patients with significant re-
idual mitral regurgitation on transthoracic echocardiography following mitral valve repair underwent multiple transesophageal echocardiography (TEE) examina-
tion to Doppler and two-dimensional echocardiography, data for three-di-
imensional echocardiography reconstruction were obtained. Echolony of re-
idual regurgitation comprised progression of the disease with dehiscence of an unnoplus plastic (82%), isolated progression of the disease (12%) and malposition of aunnoplus ring with progression of the disease (6%). The most common dehiscence site was at the posterior part of mitral annulus (F3) and the rate was gradually decreasing to the anterior leaflet at ante-