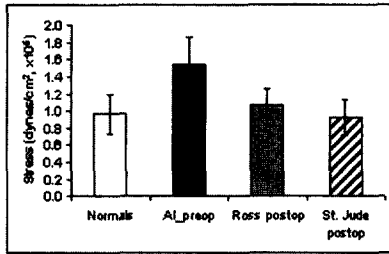


There was no significant global or regional difference in stress between the two groups (chart).

Conclusion: ESS normalized (normal stress defined as mean±2SD in normals) after AVR with St. Jude mechanical aortic valve being as good as the Ross procedure in decreasing LV afterload after surgery.



**1180-132 Three-Dimensional Geometric Change of Mitral Annulus After Mitral Valve Repair in Mitral Valve Prolapse**

Jun Kwan, Rashid M. Ahmad, Deborah A. Agler, Takahira Shiota, Delos M. Cosgrove, III, James D. Thomas, *The Cleveland Clinic Foundation, Cleveland, Ohio.*

**Background :** The aim of the study was to elucidate mitral annular geometry in mitral valve prolapse (MVP), before and after surgical repair with a Cosgrove-Edwards ring with a newly developed 3D computer program.

**Methods :** Real-time 3D echocardiography (RT3DE) was performed in 10 MVP patients, before (pre-MVR) and after mitral valve repair (post-MVR) and in 6 normals (NL). RT3DE data were digitally transferred to a PC, in which 3D data (x, y, z) of mitral annulus were manually traced at early systole (ES) and late systole (LS) by rotating the imaging plane. The 3D shape of the mitral annulus was then reconstructed using the newly developed program. Total 3D surface area (Ta), anterior (Aa), posterior annular area (Pa) and their ratio (aP/A) were calculated. For evaluation of non-planarity, the angle(α) between the vectors from both septal (S) and lateral point (L) of annulus to the center of commissure-axis was measured.

**Results:**

	ESTa (mm <sup>2</sup> )	ESAa (mm <sup>2</sup> )	ESPa (mm <sup>2</sup> )	ESaP/A	LSTa (mm <sup>2</sup> )	LSAa (mm <sup>2</sup> )	LSPa (mm <sup>2</sup> )	LSaP/A
NL	535±111	224±53	310±62	1.41	612±137	260±68	355±79	1.39
Pre-MVR	1080±249**	317±75*	762±183**	2.41**	1254±298**	359±87*	895±221**	2.5**
Post-MVR	575±124**	253±34*	321±96**	1.27**	607±132**	258±54*	349±103**	1.27**

\*: p < 0.05, \*\*: p < 0.01 compared with NL, +: p < 0.05, \*\*: p < 0.01 compared with pre-MVR

α at ES and LS of pre-MVR and post-MVR were significantly larger than normal (ES:143±5.1°, 143±6.5° vs 125±2.3°, 160±6.7°, LS:159±8.1° vs 143±3.6°, p < 0.01).

**Conclusion :** RT3DE, with a newly developed program, demonstrated that the 3D shape of mitral annulus of MVP was significantly dilated and flattened toward posterior direction compared to normals. MV repair with a Cosgrove-Edward ring reduced the posterior annular area almost to a normal range, while maintaining its saddle shape geometry.

**1180-133 Geometric Determinants of Significant Mitral Regurgitation in Patients With Severe Ischemic Cardiomyopathy**

Jun Kwan, Takahira Shiota, A. Marc Gillinov, Deborah A. Agler, Jian Xin Qin, Patrick M. McCarthy, James D. Thomas, *The Cleveland Clinic Foundation, Cleveland, Ohio.*

**Background:** This aim of this study was to determine the geometric predictors of significant mitral regurgitation (MR) in patients with severe ischemic cardiomyopathy (ICM).

**Methods:** We studied 29 patients scheduled for the Dor procedure, 15 of whom had moderate or severe MR (DorMR) and 14 with no or mild MR (DorNoMR). Real-time 3D echocardiographic (RT3DE, Volumetric Imaging) were acquired and transferred for digital analysis. Two orthogonal imaging planes of LV, [commissure-commissure (CC) and antero-posterior (AP) plane] were generated at mid-systole by 3D computer software (TomTec). The degree of lateral dilatation of LV chamber was estimated by the ratio of width of LV chamber at mid papillary muscle level to the distance from annular plane to the mid-pap level (W/D). CC and AP diameters of the mitral annulus were measured. MV tent height (Ht) and area (At) were measured in the AP plane. Angles between annular plane and both posterior (α) and anterior leaflets (β) were measured in this plane.

**Results:**

	W/D	CC(cm)	AP(cm)	Ht(cm)	At(cm <sup>2</sup> )	α(°)	β(°)
DorMR	1.62±0.1*	3.1±0.1*	2.8±0.1*	1.15±0.15*	1.33±0.34*	63±9*	39±6*
DorNoMR	1.35±0.1	3.0±0.1	2.4±0.2	0.80±0.23	0.88±0.30	45±11	31±7

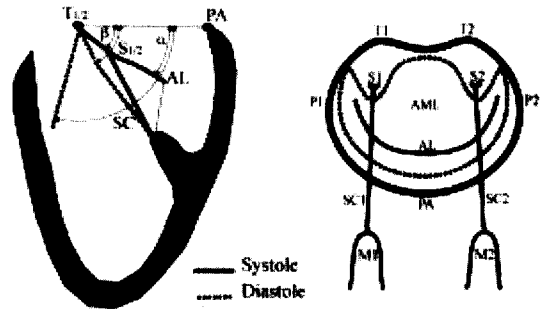
\*: p < 0.05, \*\*: p < 0.01 compared to DorNoMR

**Conclusion:** In patients with ICM with significant MR, LV chamber and mitral annulus were dilated more and the MV leaflets were more apically tethered than those without significant MR. RT3DE appears to be a unique tool for determining geometric characteristics of LV chamber and MV apparatus in patients for Dor procedure with significant MR and may be helpful in decision making of additive surgical intervention for MR.

**1180-134 Anterior Mitral Leaflet Mobility Is Limited by the Basal Stay Chords**

Wolfgang A. Goetz, Hou-Sen Lim, Emmanuel Lansac, Filip Pekar, Patricia A. Weber, Hashim A. Saber, Dietrich E. Birnbaum, Carlos M. Duran, *The International Heart Institute of Montana, Missoula, Montana, Klinik fuer Herz-, Thorax- und herznahe Gefaesschirurgie, Universitaet Regensburg, Regensburg, Germany.*

**Background:** In diastole, anterior mitral leaflet (AML) moves close to the septum. The presence of two tendon-like stay chords (SC) that remain tight during the whole cardiac cycle, should interfere with this motion. **Method:** In 6 sheep sonomicrometric crystals were implanted at: insertion of SC at AML (S1&S2); fibrous trigones (T1&T2); posterior (PA) and lateral (P1&P2) mitral annulus (MA); tip of anterior leaflet (AL). Distances were related to LV and aortic pressures before and after transection of SC. **Results:** During cardiac cycle angle between MA-plane and AL (α) changed by 44.2± 14.1°; S1 (β 1): 30.0± 12.2° and S2 (β 2): 21.8± 10.0°. During diastole AL crossed twice the virtual plane formed by the stay chords into LV outflow tract (2.5± 2.3mm). After transection of SC diastolic angles increased at AL by 4.5±3.4° (8.4±4.4% p<0.05); S1: 8.3±10.3° (7.7±10.6% p=0.05); S2: 12.2±10.3° (20.6±14.6% p<0.05) while systolic angles decreased at AL by 1.5±0.9° (8.4±5.8% p<0.05); S1: 5.8±2.8° (17.4±13.9% p<0.05); S2: 17.3±6.8 (52.5±20.6% p<0.05). Movement of AML increased at AL: 6± 13.4° (15.4±6.6% p<0.05); S1: 14.1± 12.4° (50.8±41.5% p=0.05); S2: 29.5± 15.2° (156.2±115.7% p<0.05). **Conclusion:** During diastole, while movement of lateral AML is limited by SC, the mid-portion moves unimpaired to the septum, like a sail, between two stay-chords. A diastolic LV-inflow and systolic LV-outflow funnel mechanism is created. SC-transection increased lateral AML movement. These findings should help our understanding of SAM.



**1180-135 Outcome of Cardiac Surgery in Patients With Paravalvular Abscess Detected by Transesophageal Echocardiography**

John E. Cosmi, Paul A. Tunick, Eugene A. Grossi, F. Gregory Baumann, Itzhak Kronzon, *NYU School of Medicine, New York, New York.*

**Background:** Transesophageal echocardiography (TEE) is considered to be an important technique for the diagnosis of paravalvular abscess, and surgery is the standard of care. However, the clinical outcome of patients operated on for abscess diagnosed by TEE has not been established.

**Methods:** Twenty-four pts who underwent heart surgery after the TEE diagnosis of paravalvular abscess were evaluated. Abscess was defined as paravalvular tissue swelling with or without cavity, fistula formation, or valvular vegetations.

**Results:** There were 14 males and 10 females with an average age of 66 years (range 42-86). Sixteen pts (67%) had prosthetic valves, including 12 aortic and 4 mitral valves. Eight pts (33%) had native valve infection (5 aortic, 2 mitral, 1 both). Associated valvular leaflet vegetations were present in 16 pts (67%; 9 aortic, 6 mitral, 1 both). Half of the pts had staphylococcus infections and the other half had either streptococcus, enterococcus, listeria, or negative blood cultures (2 pts). Significant valvular or paravalvular regurgitation (moderate or severe) was present in 14 pts (58%). The time from TEE to operation was a median of 1 day, and a mean of 3.5 ± 5.8 days (range 0-25 days). Fourteen pts (58%) had surgery on the same day as the TEE or the following day. In-hospital mortality was 38% (9 of 24 pts). Of the 14 pts with significant valvular or paravalvular regurgitation, 8 died (57%). Of the 10 pts with mild or no regurgitation, only 1 died (10%). This difference was statistically significant (P=0.02). There was no significant difference in mortality with respect to age, valve involved, prosthetic vs. native valve, or the presence of vegetations. Finally, there was only 1 false positive TEE (4%), with no abscess found at surgery. **Conclusion:** The postoperative mortality in pts with paravalvular abscess diagnosed by TEE is high (38%). Pts with preserved valve function have a significantly better outcome.

**1180-136 Deep Hypothermic Circulatory Arrest for the Surgical Treatment of Complicated Adult Coarctation**

Manu N. Mathur, Tomislav Mihaljevic, Lawrence H. Cohn, *Brigham and Women's Hospital, Boston, Massachusetts.*

**Background:** Recurrent adult coarctation is often associated with aneurysmal dilatation and a calcified aorta, where repair is a complicated procedure.

**Methods:** We have used deep hypothermic circulatory arrest to perform the surgical resection and grafting of adult coarctation. Hypothermia is used for optimal cerebral and spinal cord protection and circulatory arrest to avoid clamping a diseased and calcified aorta. Three patients, two females and one male, were operated on using this technique. Two had undergone previous coarctation repairs and the third was diagnosed during pregnancy. The ages ranged from 25-55. All three operations were performed through a left lateral thoracotomy. Cardiopulmonary bypass was established by femoro-femoral bypass in one patient and distal descending aorta and femoral bypass in two patients.

Patients were cooled to 13°-19°C. Using total circulatory arrest, the coarcted segment and associated aneurysm were resected followed by an interposition Hamashield graft. No crossclamps were used on the aorta. The mean circulatory arrest time was 26 minutes (range 20-30 minutes).

**Results:** There was no mortality, neurological morbidity or reoperations for bleeding. There was one temporary recurrent laryngeal nerve neuropraxia. All patients had an uncomplicated recovery. The length of hospital stay ranged from 5-10 days.

**Conclusion:** This technique for complicated adult coarctation is simple, safe and reproducible and allows anastomoses to be performed in a bloodless field with an excellent outcome. It is recommended for patients requiring reoperations on recurrent coarctations, heavily diseased and calcified aortas where clamping the aorta is associated with a high risk of embolization and all adult coarctations where collateral circulation to the spinal cord and viscera are in question.

ORAL CONTRIBUTIONS

**866 Mitral Valve Disease**

Tuesday, March 19, 2002, 2:00 p.m.-3:30 p.m.  
Georgia World Congress Center, Room 360W

2:00 p.m.

**866-1 Atrovastatin Improves an Atherosclerotic and Proliferative Lesion on the Mitral Valve Induced by Experimental Hypercholesterolemia**

Nalini M. Rajamannan, Hani I. Salti, Raffay Khan, Robert H. Bonow, Sameer Gupta, Parag Jain, Neil Stone, Robert O. Bonow, *Northwestern University Medical School, Chicago, Illinois.*

**Background:** Epidemiologic studies have linked degenerative mitral valve disease to risk factors for atherosclerosis. In this study, we characterized the pathology of the mitral valve in a hypercholesterolemic (chol) rabbit model. **Methods:** 18 rabbits were assigned to 3 groups: normal diet, chol(1%) diet, and chol (1%) plus atorvastatin(2.5 mg/kg)(Atorv). At 8 weeks, the mitral valves were harvested. Immunohistology of the mitral valves was performed using markers found in arterial atherosclerotic lesions: anti-macrophage RAM-11, anti-alpha-actin, and anti- PCNA, DNA Polymerase Nuclear Antigen. Bone matrix expression was determined with anti-osteopontin antibodies. A 5-point grading system to describe the staining on the valves. (0-4 (high)). PCNA quantification was performed on all tissues with a computerized analysis system. (\* p<0.001)**Results:** . All of the mitral valves harvested from the chol-fed group were morphologically abnormal. Macrophage, alpha-actin, osteopontin and PCNA were increased in the chol rabbits. Ator decreased the level of atherosclerosis, proliferation and bone matrix expression in these valves. **Conclusion:** Experimental hypercholesterolemia induces proliferation and osteopontin expression in the mitral valve that are typically seen in arterial atherosclerotic lesions. These changes may be modified with the use of a lipid-lowering agent. These findings may provide a useful model to study the development of mitral valve disease.

	Normal	Cholesterol	Cholesterol+ Atrovastatin
Chol (mg/dl)	51+/-12	3235/-329	1943+/-17*
RAM-11	0+/-0	1.83+/-1.5	0.27+/-0.06*
alpha-actin	0.6+/-0.8	3.0+/-0.6	1.3+/-0.97*
osteopontin	+	++++	++
PCNA	0+/-0	81+/-17	22+/-10*

2:15 p.m.

**866-2 N-Terminal Brain Natriuretic Peptide Predicts Symptomatic Status and Severity of Mitral Regurgitation in Patients With Mitral Regurgitation**

Timothy M. Sutton, Andrew J. Kerr, Ivor L. Gerber, Ralph A. Stewart, Teena West, Sally C. Greaves, Malcolm E. Legget, Tim G. Yandle, A. Mark Richards, *Middlemore Hospital, Auckland, New Zealand, Greenlane Hospital, Auckland, New Zealand.*

**Background:** Timing of surgical intervention for mitral regurgitation (MR) is currently based on symptomatic status and echocardiographic parameters, with the aim of preserving left ventricular (LV) systolic function and prolonging survival. Identification of patients with severe MR and normal LV function whose ventricles are in the early stages of decompensation would enhance patient management and highlight those who may benefit from surgical therapy.

Our aim was to assess whether N-terminal brain natriuretic peptide (N-BNP) correlates with quantitative echocardiographic assessment of MR and symptomatic status.

**Methods:** Consecutive patients (n=34) with isolated mitral regurgitation and normal LV systolic function were identified. Patients with other potential causes for elevation of N-BNP were excluded. All patients underwent transthoracic echo and N-BNP assay. Symptomatic status was assessed according to the NYHA classification.

**Results:** N-BNP was higher in symptomatic than asymptomatic subjects: symptomatic (n=10, median 117pmol/l, IQR 54-175pmol/l) vs. asymptomatic (n=24 median 30pmol/l, IQR 20-62pmol/l) (p=0.009)

There was a moderate correlation between ln(N-BNP) and left atrial size (r=0.64, p=0.0001), mitral regurgitation score (r=0.54, p=0.0009), regurgitant fraction

(r=0.48, p=0.0009), vena contracta width (r=0.5, p=0.0009), left ventricular end systolic diameter index (r=0.47, p=0.0048) and left ventricular end diastolic diameter index (r=0.47, p=0.0053)

After adjusting for age and gender both higher ln(N-BNP) (p=0.01) and severity of MR assessed by vena contracta width (p=0.01), regurgitant fraction (p=0.01) and MR score (p=0.03) were associated with NYHA class.

**Conclusion:**

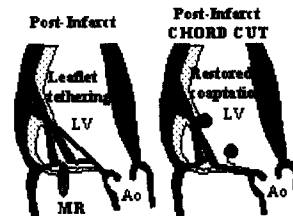
N-BNP increases with the severity of MR and with left ventricular dimensions. Measurement of N-BNP may improve assessment of MR in the context of normal LV function when clinical and/or echocardiographic data are inconsistent.

2:30 p.m.

**866-3 Chronic Persistent Efficacy of Basal Chordal Cutting to Relieve Ischemic Mitral Regurgitation**

Emmanuel Messas, J. Luis Guerrero, Mark D. Handschumacher, Judy Hung, Noah Liel-Cohen, Suzanne Sullivan, Gus Vlahakes, Robert A. Levine, *Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts.*

Mitral regurgitation (MR) conveys adverse prognosis in ischemic heart disease. Related to increased leaflet tethering by displaced attachments to the papillary muscles (PMs), it is incompletely treated by annular reduction. We therefore addressed the **hypothesis** that such MR can be reduced by cutting a limited number of critically positioned chordae to the leaflet base that most restrict closure but are not required to prevent prolapse. We compared two group of sheep: Group 1 (n=10) with chronic inferobasal infarcts known to give progressive MR and group 2 (n=5) with the same infarct site but with the two basal chordae cut at the time of the infarction. We analyzed 3D echo at infarct and chronic stage (8 weeks for group 1 and a mean of 33 weeks for group 2) for 3D valve geometry, LV volume and function, and MR stroke volume. **Results:** In Group 1, MR consistently increased over time as the LV remodeled (1.3 ± 0.5 to 10.5 ± 1.5 ml/beat, p < 0.01). In Group 2, no significant MR developed after a mean follow-up of 33 weeks (maximum, 43 weeks) with no prolapse, flail, or significant post-infarct decline in LV function. **Conclusion:** Cutting a minimum number of basal chordae is persistently effective against ischemic MR over time without evident adverse effects.



2:45 p.m.

**866-4 Timing of Mitral Valve Closure: The Myth of the Isovolumic Contraction**

Emmanuel Lansac, Khee Hiang Lim, Yu Shomura, Hou Sen Lim, Wolfgang Goetz, Scott Stevens, James H. Oury, Christophe Acar, Carlos M. Duran, *The International Heart Institute of Montana Foundation, Missoula, Montana, La Pitié Salpêtrière Cardiac Surgery department, Paris, France.*

**Background:** Mitral valve closure is known to define end diastole. However the exact timing of the mitral valve closure remains controversial.

**Methods:** Twelve piezoelectric crystals (Sonomicrometry) were implanted in 7 sheep at: mitral annulus (trigones T1-T2, transverse diameter P1-P2, antero posterior diameter AM-PM); free edge of anterior and posterior leaflet; tip of each papillary muscle (M1, M2); Left ventricular endocardial wall opposite to the papillary tips (LVOT); apex of the left ventricle. The mitral valve was divided into 4 functional units: mitral annulus area; Anterior annulo-papillary apparatus (area between T1-T2-M1-M2); Posterior annulo-papillary apparatus (area between P1-P2-M1-M2); Papillary muscle area (area between M1-M2-LVOT).

**Results:** The mitral valve was still open at end diastole since 57.2±4.3% (mean±SEM) of the closure occurred during the isovolumic contraction. Closure was only completed at the end of the isovolumic contraction (gradient Aorta-LV=0). During this phase, the mitral valve movements were time related to LV pressure increase and corresponded to a complex deformation. All mitral valve levels underwent an early expansion followed by a contraction during the second part of the isovolumic contraction. This contraction had a wave progression starting in the left ventricle at the papillary muscle followed by the contraction of the anterior annulo-papillary apparatus (p= 0.00002) then the posterior annulo-papillary apparatus (p=0.022) and at last the mitral annulus contraction (p=0.084). During systole the inter-papillary muscle distance contracted the most (M1-M2: -25.2±1.9%) while the mitral annulus area contracted by -16.1±1.9 %. However the length of the basal chords of the anterior leaflets (strut chord) remained almost constant (T1-M1: -2.7±0.4%; T2-M2: -2.0±0.2%) whereas the distance between the posterior part of the mitral annulus and the tip of the papillary muscle expanded (P1-M1: +6.0±0.8%; P2-M2: +9.0±1.4%).

**Conclusion:** The mechanism of closure corresponded to a precise chronological deformation. The timing of mitral valve closure was surprising. These findings should question the definition of the isovolumic contraction.