Chordal Cutting to Relieve Mitral Leaflet Tethering Diminishes LV Remodeling Following Chronic Inferior Myocardial Infarction

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Background. We have previously demonstrated that severing two second-order chordae to the anterior mitral leaflet (AL) in sheep does not adversely affect LV size and function acutely. **Objectives.** This study tested whether chordal cutting exacerbates long-term LV remodeling when applied to treat ischemic mitral regurgitation (MR) in a chronic myocardial infarction (MI). **Methods.** A posterolateral MI was created in 18 sheep by ligation of obtuse marginal branches. After chronic remodeling and MR development at 2 months, sheep were randomized to sham surgery versus anterior leaflet (AntL) or bileaflet (BiL) second-order chordal cutting (n=6 each), techniques in clinical application. 2D and 3D echo at baseline, chronic infarction (2 months), and follow-up at a mean of 6.5 months post-MI (sacrifice) measured LV end-diastolic and end-systolic volume (EDV and ESV), ejection fraction (EF), wall motion score index (WMSi), and posterior leaflet (PL) restriction angle relative to the annulus. **Results.** All measurements were comparable among groups at baseline and chronic MI. At sacrifice, AntL and BiL chordal cutting limited the progressive remodeling seen in controls. LVESV increased by 33±7.2% and 28±5.0% relative to chronic MI with AntL and BiL chordal cutting, versus 109±8.7% in controls ($p<0.01$) (LVESV=60.6±5.1ml vs 61.8±4.1ml vs 82.5±2.6ml in controls). LVEDV increased by 26±5.5% and 22±3.4% with AntL and BiL chordal cutting, versus 63±2.0% in controls ($p<0.01$). LVEF and WMSi were not significantly different at follow-up among chordal cutting and control groups. MR progressively increased to moderate in controls but decreased to trace-mild (vena contracta ≤2mm) in 83% of chordal cutting sheep. BiL chordal cutting provided greater PL mobility (decreased PL restriction angle to 54±5° versus 93±3° with AntL chordal cutting, $p<0.01$). **Conclusions:** Cutting secondary chordae in the chronic post-MI setting does not adversely affect long-term LV remodeling, and limits progressive increases in LV volumes.

Thrombolytic Therapy for Obstructive Prosthetic Heart Valve Thrombosis – 11 Years Perspective

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Background: Thrombolytic therapy (TT) can be an alternative to re-do surgery in patients with obstructive prosthetic valve thrombosis (OPVT). We present our immediate and long-term results.

Methods and Results: Within 11-years period, 65 patients were admitted with OPVT, involving mostly bileaflet valves (61/65, 94%). Forty-seven (age 55.6±15.3, male/female = 17/30) received TT, after excluding high-risk thrombi by TEE. Valve position was mitral (31), aortic (7) and tricuspid (9). Full response to thrombolysis was 31/47 (66%) – 65%, 57% and 78% for MVR, AVR and TVR, respectively. Five patients had partial response. There was no procedure-related mortality. Five patients (10.6%) developed neurological complications (2 hemorrhagic), only one with mild persistent residua. Major bleeding occurred in 2 patients. Fourteen patients (30%) required reoperation after unsuccessful TT. Late death occurred in 6/31 (19%) of initial responders. Repeated episodes of OPVT occurred in 10 patients (40% of 25 late survivors) – accounting for a total of 26 additional episodes. Re-thrombolysis was uniformly successful. A total of 20/47 (43%) of patients with primary thrombolytic approach eventually underwent valve re-replacement (14 after thrombolytic failure, 5 after recurrences, 1 as an adjunct to CABG). 22 initial responders were alive with their original valve after 66±38 months (range 13-121), with NYHA functional class 1.7±0.1.

Conclusions: Thrombolysis is an acceptable and relatively safe alternative to surgery in OPVT, and may offer long-term freedom from reoperation in more than half of patients. Repeated episodes are frequent, but usually respond to re-thrombolysis. Predictors of complications should be sought, especially in non-emergent cases.

Progression of Mitral Regurgitation in Patients with Mitral Valve Prolapse and Less than Moderate Regurgitation

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Background: Mitral valve prolapse (MVP) is a progressive disease. However, few data exists regarding the rate of progression and predictors for developing significant mitral regurgitation (MR).

Aim: To describe the rate and identify predictors of MR progression in patients with MVP and non significant MR.

Methods: Retrospective study of patients with < moderate MR who had echocardiographic follow up of > 1 year. Clinical and echocardiographic data of patients without progression of MR was compared to those who developed moderate to severe or severe MR over time.

Results: There were 114 patients with MVP. Grade of MR was none in 4, minimal in 3, mild in 66 and mild to moderate in 41. The mean age was 52 years (20-97) and 61 (53%) were male. Bileaflet prolapse was present in 45 (39%), posterior prolapse in 44 (38%) and anterior prolapse in 26 (23%) of patients. Over a mean follow up period of 55 ± 29 months, there were only 16 (14%) patients who developed moderate to severe (10) or severe (6) MR. This subgroup of patients was older (62.6 vs. 50.4 years;
$p < 0.001$) and most were men (69% vs. 51%; $p = 0.28$) as compared to the non progressive group. Flail leaflet occured in 8 (50%) of these patients and infective endocarditis in none. Posterior prolapse was originally present in 75% (12 pts) vs. 29% (33 pts) of patients with and without significant progression of MR, respectively ($p = 0.002$). Prolapse of the second leaflet was reported in follow up echocardiography for 20 patients (18%) without progression vs. only 1 patient (6%) with progression of regurgitation
($p = 0.3$).

Conclusion: The majority of patients with MVP and non significant MR progress slowly. Those who develop significant mitral regurgitation are more likely to be older, and have posterior leaflet prolapse. Development of prolapse of the second mitral leaflet is not uncommon in those without progression of MR.

Determinants of Pulmonary Artery Pressure in Patients with Aortic Valve Stenosis

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Background and Objectives: Severe elevation of pulmonary artery systolic pressure (PAP) is not a typical feature of aortic valve stenosis (AS), yet it is occasionally observed. The objectives of our study were: 1) to determine the distribution of PAP in patients with severe AS; 2) to determine the factors associated with elevated PAP in these patients.

Methods: The computerized database of the echocardiography laboratory at our institution was used to identify consecutive patients with severe AS (aortic valve area ≤1 cm^2). The echocardiographic reports of these patients were reviewed and the relevant echocardiographic data was collected. The distribution of PAP in these patients and the factors associated with elevated PAP were determined.

Results: Among 155 patients with severe AS identified during a 22 months period (age: 75±11 yrs; 37% men) – PAP was <35 mmHg in 42 (27%) patients, 35-49 mmHg in 65 (42%) patients, 50-69 mmHg in 36 (23%) patients, and ≥70 mmHg in 12 (8%) patients. The results of the age and sex-adjusted multivariate analysis are listed below. Adjusting for age and gender – reduced left ventricular ejection fraction (LVEF) and elevated mitral inflow E/A ratio (a marker of left ventricular diastolic function) were the only the variables that were independently associated with elevated PAP (PAP ≥50 mmHg). Reduced aortic valve area was associated with elevated PAP by univariate (but not multivariate) analysis.

	OR	**95% CI**	**P**
Age	1.2	0.7-2.0	0.56
Female gender	0.2	0.04-0.8	0.03
LVEF <45%	12.5	2.5-61.3	0.002
Mitral inflow E/A ratio >1.5	6.2	1.4-27.5	0.02

OR = odds ratio for elevated PAP (≥50 mmHg); CI = confidence interval.

Conclusions: PAP is frequently elevated (at times – severely elevated) in patients with severe AS. Reduced left ventricular function (systolic and diastolic) are associated with elevated PAP in these patients, wheras the association of AS severity with elevated PAP is questionable. Thus, it appears that the ventricular response to AS, probably not the severity of AS by itself, is the main factor underlying the pathogenesis of pulmonary hypertension in patients with AS.

The Role of ECG - gated MDCT in the Evaluation of Aortic and Mitral Mechanical Valves

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Purpose

To evaluate the role of ECG-gated multi-detector CT (MDCT) in the functional evaluation of mechanical prosthetic aortic and mitral valves.

Patients and Methods

Twenty sequential patients with 23 mechanical prosthetic valves were evaluated with a 40/64 ECG-gated MDCT scanner. Multi-Planar Reformation, Maximal Intensity Projection, Volume Rendering and Average techniques were used for the visualization of the valve leaflets in systole and diastole. Visibility of each mechanical valve was evaluated by a consensus of a radiologist and a cardiologist, using a subjective fivepoint scale. MDCT findings were correlated with fluoroscopic opening and closing angle measurements and echocardiographic pressure gradient measurements in 11 and 19 valves respectively.

Results

The series included 18 bileaflet and five single-leaflet mechanical valves. Visibility score for MDCT-based computerized reformations of bileaflet mechanical valves was excellent (4/4) in all 18 cases. However, visibility scores of single-leaflet valves were lower (mean =2.8/4, range 1-4), with 2/5 cases in which the leaflets location and angles could not be clearly identified by MDCT during systole and diastole. In four patients a stuck valve was demonstrated on MDCT and confirmed by fluoroscopy while in all remaining cases free movement of mechanical leaflets was demonstrated clearly with normal opening and closing angles. Echo-Doppler showed an increased trans-valvular pressure in one of the four patients with stuck mitral valve while an increased trans-aortic pressure was noted in three patients with normal prosthetic aortic valve motion.

Conclusion

Our preliminary results suggest that MDCT is a promising technique for functional evaluation of bileaflet mechanical valves, allowing reliable measurements of opening and closing leaflet angles. However, the role of MDCT in the evaluation of single leaflet valves might be limited.

Aortic Valvuloplasty for Symptomatic Non-Surgical Aortic Stenosis with Concomitant Regurgitation - Indication or Contra-Indication?

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BACKGROUND: Degenerative aortic stenosis (AS) is the most frequent valvular disease in western world. Due to its high incidence in elderly population with frequent co-morbidities, the risk is often too high for surgical valve replacement. Balloon aortic valvuloplasty (BAV) was introduced two decades ago as a palliative procedure for high risk patients. Aortic regurgitation (AR) is frequently associated with AS. The potential worsening of AR by BAV is considered a major complication and thus a relative contra-indication for BAV. To examine the feasibility of combined AS and AR for BAV, we retrospectively analyzed our center experience with BAV performed in patients with AR.

METHODS AND RESULTS: We retrospectively analyzed our database for severe AS patients that underwent BAV during years 2005-2007 and had also significant AR. Nine patients (age 85±2.7) were found. Aortic valve area increased from 0.5±0.15 to 0.9±0.2 cm2. Maximal and mean pressure gradients across the valve decreased from 72±19.5 to 46±13.6 and from 38±12 to 23±6.8 mmHg, respectively. Pre-BAV all patients had at least moderate AR (pressure half time 250±107 ms). Post- procedure there were no cases of hemodynamic deterioration; Echocardiographic AR worsening was noted in 3/9 (33%) cases, no change in 4/9 (45%), and AR improvement in 2/9 (22%). On the whole, AR severity did not change (pressure half time 245±99 ms).

CONCLUSIONS: Based on our series and review of the literature the risk of hemodynamically significant deterioration of pre-existent AR after BAV is very low. Thus, BAV should not be denied from patients with severe symptomatic AS that are not candidates for surgery.

Functional Mitral Regurgitation Assessed by Echocardiographic Sphincter Index

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Background: The abnormal systolic sphincter mechanism in functional mitral regurgitation (FMR) is generally due to either annular and/or left ventricular pathologies.
Aim: We tested a simple TTE index in two varieties of FMR by evaluating the mitral systolic sphincter mechanism.
Material and Methods: Adults with competent mitral valve and 2 different group with FMR; dilated cardiomyopaty (DCM) and ischemic etiology were included. Mitral regurgitation (MR) severity was determined by Colored -Doppler criteria.
In each group, minimal inter papillary muscle distance (IPMD-mm-B) by left parasternal short axis view and mitral valve annular diameter (MVAD-mm-A) by apical 4 chamber view were measured during systole in order to assess valvular sphincter function. The mitral sphicter index was calculated as B/A.
Results: Pts clinical characteristic, MR severity in each group, the measured TTE parameters including the calculated sphincter index are presented in the table.

Characteristics Number of pts	Normal 13	DCM 13	Post Ant MI 12	Post Inf. MI 11	P value
Age	42±14	42±17	58±11	63±14	0.001
Gender (male %)	46	54	92	82	0.044
STEMI (%)	Ø	Ø	83	64	ns
Mild MR	Ø	54	67	73	ns
Moderate MR (%)	Ø	23	33	9	ns
Significant MR (%)	Ø	23	0	18	ns
IPMD (mm) B	9±2	18±5	12±3	11±3	<0.001
MVAD (mm) A	30±4	38±5	32±5	31±3	<0.0001
B/A: Sphincter Index	0.29	0.49	0.37	0.37	<0.0001

Ischemia induced FMR was more prevalent in adult male whereas severe MR was not found after single Anterior wall MI. The largest IPMD and MVAD were found among pts with DCM manifested as largest abnormal sphincter index
Conclusions: The TTE derived abnormal sphincter mitral index can differentiate between the two etiologies of FMR and potentially may used as a tool for planning therapeutic approach.