

SCA25

EVALUATION OF PULSE PRESSURE VARIATION AS AN INDICATOR OF HEMODYNAMIC INSTABILITY AND A PREDICTOR OF FLUID RESPONSIVENESS DURING THE DISPLACEMENT OF HEART IN PATIENTS UNDERGOING OFF-PUMP CORONARY ARTERY BYPASS SURGERY

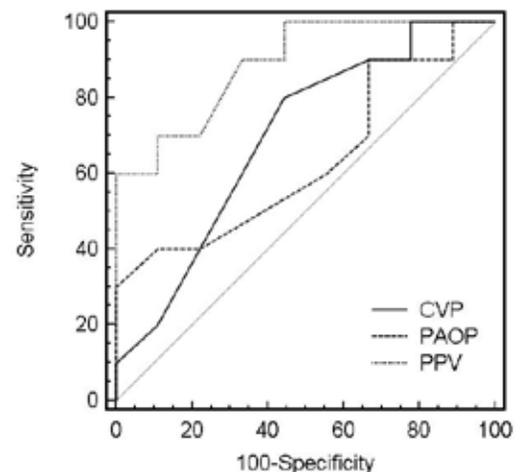
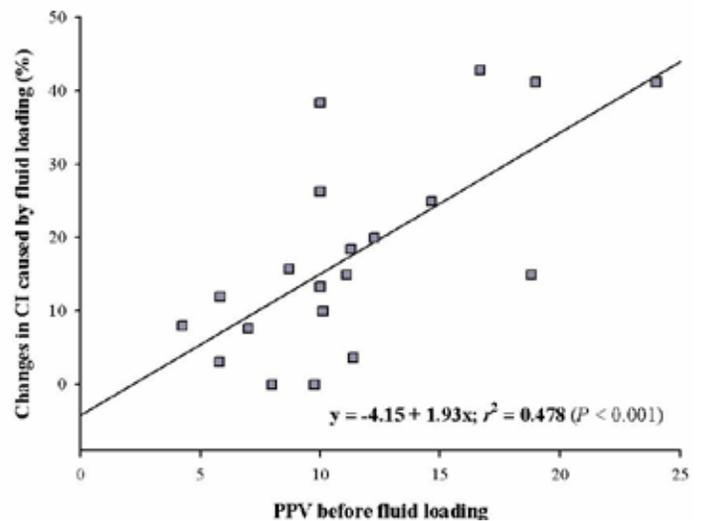
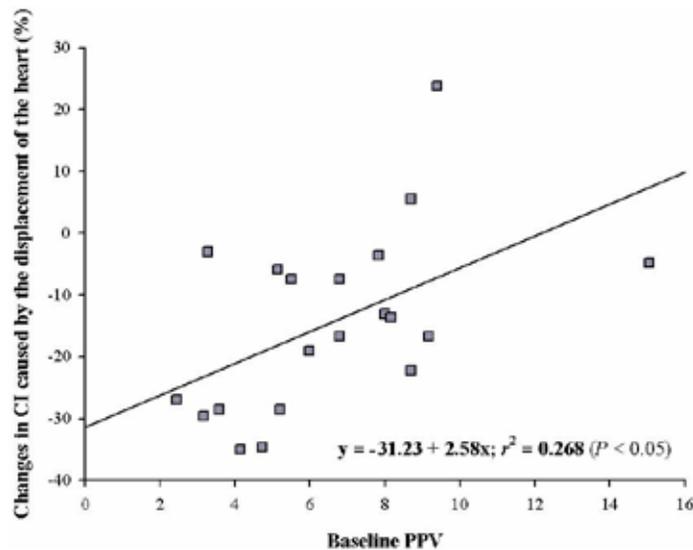
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Background. Pulse pressure variation (PPV) has reported to predict fluid responsiveness in patients undergoing coronary artery bypass surgery. The purpose of this study was to assess whether baseline PPV correlate the degree of hemodynamic instability during the enucleation of the heart and whether PPV can predict fluid responsiveness in the course of the dislocation of the heart. **Methods.** Twenty patients undergoing off-pump coronary artery bypass (OPCAB) surgery were included in this study. PPV, cardiac index (CI), and other hemodynamic data were measured baseline and 5 minutes after the displacement of the heart, and 5 minutes after fluid loading with 6% hydroxyethyl starch solution (10 ml/kg). Linear regression was used to assess correlations between displacement-related changes in CI and baseline hemodynamic variables and between changes in CI after fluid loading and hemodynamic variables before volume expansion, respectively. Receiver operating characteristic (ROC) analysis was used to evaluate the predictive value of PPV during the displacement of the heart to the response to volume expansion, as defined by an

increase in CI of 15% or more. **Results.** Baseline PPV correlated negatively with changes in CI after the enucleation of the heart ($r^2=0.27$, $P<0.05$). However, PPV during the displacement of the heart correlate positively with changes in CI after fluid loading ($r^2=0.48$, $P<0.01$) (Figure 1). Area under ROC curves for PPV (0.889 ± 0.076) was significantly greater than that for pulmonary artery occlusion pressure (0.633 ± 0.131 , $P<0.05$) (Figure 2). The optimal threshold value given by ROC analysis was 10.1% for PPV. **Conclusion.** PPV was an accurate predictor of fluid responsiveness when the heart was displaced during OPCAB surgery. However, Baseline PPV showed negative correlation with changes in CI during the displacement of the heart.

Figure 1. Relation of baseline PPV and change in CI caused by the displacement of the heart (A) and relation of PPV before fluid loading and change in CI caused by fluid loading (B).

Figure 2. ROC curve comparing the ability of CVP, PAOP, and PPV to discriminate the responders and the non-responders.



SCA26

VALUE OF AUGMENTED REALITY ENHANCED TRANSESOPHAGEAL ECHOCARDIOGRAPHY (TEE) FOR DETERMINING OPTIMAL ANNULOPLASTY RING SIZE DURING MITRAL VALVE REPAIR

Ender J; Koncar Zeh J; Mukherjee C; Jacobs S; Borger M; Gessat M; Falk V

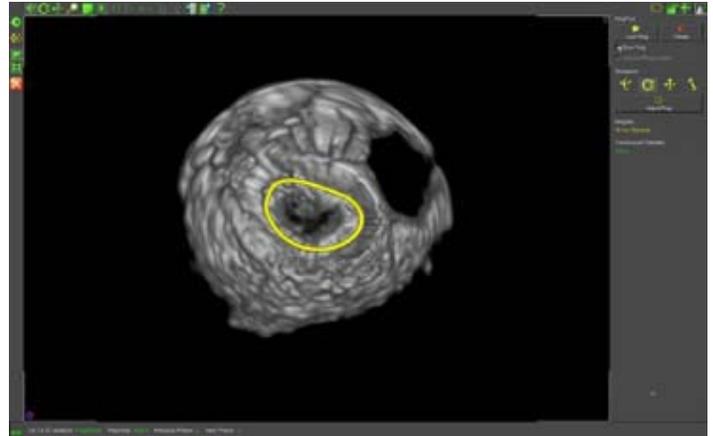
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Background: Mitral valve (MV) annuloplasty is an integral part of MV repair surgery. However, controversy exists as to the optimal method of sizing of the MV annulus when implanting an annuloplasty ring. The aim of this study was to investigate the potential value of augmented reality enhanced transesophageal echocardiography (TEE) for determining optimal annuloplasty size in MV repair.

Methods: In patients undergoing elective MV repair, a three dimensional reconstruction of the MV was performed using TEE. A modified software based on 4D valve assessment® (TomTec, Munich, Germany) was used to create 3D Computer Aided Design-models (CAD -models) of standard annuloplasty rings (28 to 36 mm) which were stored in a digital database. These virtual 3D annuloplasty ring templates were subsequently superimposed on the preoperative 3D-TEE reconstructions of the MV and results were compared to conventional sizing under direct vision. In addition, a post-hoc validation of the 3D-models was performed using the implanted rings as a control. The echocardiographer was blinded to the implanted ring size.

Results: Fifty patients were included in the study. The correlation between the selected 3D annuloplasty ring template and the implanted annuloplasty ring size was 0.83. Thirty ring templates (60%) were the same size as the implanted annuloplasty ring and 20 templates (40%) differed by ± 2 mm in size.

Postoperatively, the validation protocol revealed a correlation of 0.94 between the size of the ring templates and the implanted annuloplasty prostheses. **Conclusions:** Augmented reality enhanced TEE for determining optimal annuloplasty ring size during MV repair correlates well with conventional surgical sizing. A prospective randomized study is necessary to evaluate the clinical value of this new approach.



SCA27

IMPACT OF 3D TRANSESOPHAGEAL ECHOCARDIOGRAPHY IN IMPROVING IDENTIFICATION OF MITRAL VALVE PATHOLOGY

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Background: Perioperative assessment of the mitral valve (MV) with 2D transesophageal echocardiography (TEE) is a challenging task for the echocardiographer and requires a unique set of skills and experience. This is primarily due to the complex saddle-shaped nature of the MV which makes it particularly suited to 3D assessment. 3D evaluation of the MV with the recently introduced Real-Time (RT) 3D-TEE may facilitate an accurate assessment of the MV also for the inexperienced observer, as recently shown for reconstructed 3D images. This study was designed to compare the accuracy of RT-3D-TEE and 2D-TEE in identifying the segmental involvement and underlying pathology of mitral regurgitation (MR) between an experienced and an inexperienced observer.

Methods: With IRB approval, 2D-TEE and RT-3D-TEE images from 23 patients undergoing MV repair or replacement were studied. All patients underwent a comprehensive TEE evaluation before cardiopulmonary bypass including standard 2D images for evaluation of the MV (four mid-esophageal views) as well as the 3D en face view (see figure) with the RT-3D TEE Matrix transducer (IE33 system; Philips Medical Systems). Digitized images were assessed off-line by a board-certified echocardiographer and a resident in training (novice) while blinded to surgical intervention and findings. Both observers were asked to identify any

abnormal segments of the MV as well as the pathology leading to MR. Correct or incorrect assessments of each of the six segments of the MV and of the underlying pathology were determined by comparison with the surgical finding as the gold standard. The McNemar test was used to compare 2D and 3D technique (separately for each rater) and to compare raters (separately for 2D and 3D).

Results: Off-line analysis of all but four segments (in two patients) was feasible using 3D images. There was no difference between 2D and 3D assessment of the MV neither for the experienced, nor for the novice observer (see table). Comparing the experienced and the novice observers, again no difference was demonstrated when 2D and 3D-TEE images were reviewed off-line.

Conclusion: When reviewed off-line, the 3D en face view of the MV does not add value to the 2D-TEE assessment of MV pathology or segmental involvement of the MV in the setting of MR. This observation holds true for both, the experienced and a novice observer. Surprisingly, the accuracy of MV assessment when performed off-line was lower than expected for both the experienced and the novice observer, independent of the technique used. These results suggest the importance of real-time examination for a comprehensive and accurate assessment of the MV.

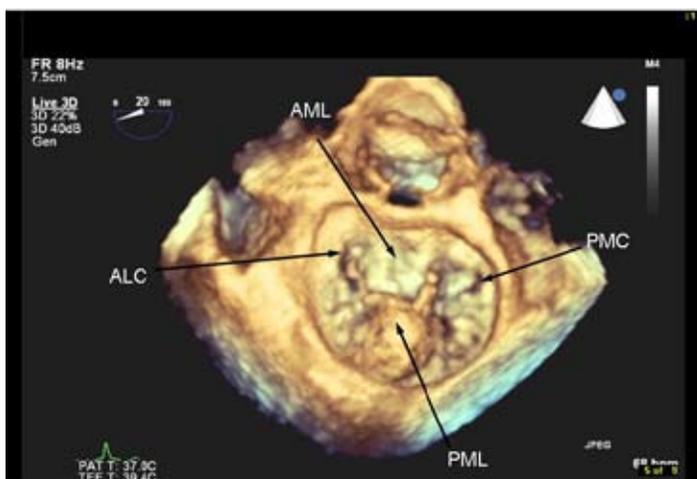


Figure: The *en-face* view of the mitral valve corresponding to the surgical view obtained by the real-time three dimensional transesophageal echocardiography. The P2 segment of the posterior mitral leaflet shows a prolapse and flail. PML = posterior mitral leaflet; AML = anterior mitral valve leaflet; ALC = anterolateral commissure; PMC = posteromedial commissure

Segment analysis	2D (% correct)	3D (% correct)	McNemars (comparing views)
Novice	57.97	64.49	.27
Experienced	61.65	53.38	.09

Table: The table shows the comparison between the 2D and 3D TEE for both raters. The percentage of accurately rated segments was obtained by comparison to the surgical finding.

SCA28

TRANSESOPHAGEAL ECHOCARDIOGRAPHIC FEATURES OF ENDOLEAKS AFTER STENT-GRAFT PROCEDURES FOR CHRONIC TYPE B AORTIC DISSECTION: RELATION TO FOLLOW-UP RESULTS

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Background. Transesophageal echocardiography (TEE) is useful for detecting endoleaks after stent-graft deployment. However, the clinical significance of endoleaks detected on TEE is often unclear.

Methods. In 11 patients who underwent endovascular stent-grafting, intraoperative TEE examinations were performed to evaluate closure of the intimal tear. Spontaneous echo contrast (SEC) in the false lumen, grading of entry flow at the intimal tear, and motion of the stent-graft were assessed. Contrast-enhanced computed tomography (CT) was performed on the day of surgery (POD 0) and 10 days (POD 10) and 30 days (POD 30) after stent-grafting. Further follow-up contrast-enhanced CT was subsequently performed at 6-month intervals. The results of TEE examinations were compared with those of follow-up assessments of the endoleak by enhanced CT.

Results. The severity of endoleaks were visually graded as 3 (residual entry), 2 (mosaic turbulent flow), 1 (color flow without the appearance of a mosaic jet), and 0 (no appearance of color flow). The grading of endoleaks on CDFM was significantly associated with CT endoleaks on POD 0 ($P=0.005$, Mann-Whitney U test). CT endoleaks on POD 30 were significantly associated with the absence of a stasis pattern and with dyskinetic motion of the stent-graft ($P=0.003$, $P=0.02$, Fisher exact test, respectively). Mean follow-up was 74 months (range, 3 to 117 months). In mid-term period (1 to 24 months), all of three TEE features were associated with persisted primary endoleaks by CT. In long-term (over 2 years), all TEE features were associated with aortic rupture or conversion to open surgery.

Conclusions. On long-term follow-up, unfavorable intraoperative findings on TEE, such as mosaic perigraft leakage and dyskinetic motion of the stent-graft, are associated with an increased risk of aortic rupture or late conversion to open surgery.

SCA29

SPECKLE TRACKING IMAGING PROVIDES UNIQUE INSIGHT INTO LEFT VENTRICULAR SYSTOLIC FUNCTION---
ASSESSMENT OF LEFT VENTRICULAR ROTATIONZhou W¹; Ashraf M¹; Marcucci C²; Swaminathan M²; Mahajan A¹*UCLA¹, Los Angeles, CA, USA; Duke Medical Center², Durham, NC, USA*

Background: Speckle tracking echocardiography (STE) has recently been validated as a useful tool to quantify regional myocardial function. Left ventricular (LV) torsion, due to counter-directional basal and apical rotation has been proposed as a sensitive marker of LV function. The aim of this study is to assess the accuracy and reliability of left ventricular twist as a non-invasive index of LV systolic function.

Methods and Results: In 7 open-chest pigs, echocardiographic imaging and pressure-volume (PV) signals were simultaneously acquired during pharmacological interventions. Apical and basal rotations were measured from short-axis images using automatic frame-to-frame tracking of gray-scale speckle patterns. Images were exported to EchoPac PC for offline analysis of twist. Apical

rotations increased from 6.9 to 9.3 during dobutamine infusion and decreased from 6.9 to 2.9 during esmolol infusion. However, basal rotations did not change during dobutamine infusion and decreased from 4.6 to 3.4 during esmolol infusion. Global peak apical rotation and basal rotation closely correlated with indices of systolic function based on PV relationship: dP/dt max ($r = 0.94$, $r = 0.77$), Emax ($r = 0.67$, $r = 0.7$). During caval occlusion (30% EDV reduction), the apical rotation increased, whereas the basal rotation unchanged.

Conclusions: LV rotation and torsion provide quantitative, reproducible, and relatively load-independent indices of global LV systolic function.

SCA30

SPECKLE TRACKING IS SUPERIOR TO TISSUE DOPPLER FOR INTRAOPERATIVE TRANSESOPHAGEAL ECHOCARDIOGRAPHY STRAIN ANALYSIS AND ENABLES ASSESSMENT OF SEQUENTIAL VENTRICULAR CONTRACTION

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Introduction: To date, few transesophageal echocardiography (TEE) data in human patients have been presented on the nature of sequential contraction and strain as it relates to the Helical Myocardial Band[1]. Tissue Doppler imaging (TDI) and speckle tracking echocardiography (STE) are tools for measuring strain with echocardiography [2]. We evaluated the feasibility of TDI versus STE with intraoperative TEE to evaluate sequential contraction of the descending and ascending segments in patients presenting for CABG surgery.

Methods: After IRB approval and informed consent 21 patients presenting for CABG surgery had a complete TEE exam with additional images optimized for TDI and STE of the septum. Effort was made to align the septum at less than 20 degrees for Doppler interrogation. STE software alerts the user if it cannot track a segment whereas TDI strain software automatically produces a curve for any segment. Longitudinal strain by TDI and STE was compared for the basal, mid and apical portions of the septum by paired t-test and Pearsons correlation with $p < 0.05$ considered significant. For TDI, the angle of interrogation was measured for each segment and compared by Chi-square analysis. All image analysis was done off-line with EchoPac software (GE, Milwaukee, WI).

Results: Among the 21 patients enrolled 1 patient was eliminated due to the poor quality of TDI images. The mean angles of interrogation in the septal segments analyzed with TDI were: 25.9, 17.7 and 34.8 degrees for the base, mid and apex, respectively.

The proportions of angles greater than 20 degrees (base 15/20, mid 6/20, apex 20/20) were significantly different by segment ($p < 0.0001$). Among the 20 subjects studied with STE 56 of 60 segments were available for analysis. Longitudinal strain measured by TDI differed significantly from longitudinal strain measured by STE ($p < 0.0001$). There was no correlation between the longitudinal strain by TDI vs. STE ($r = -0.1, p = 0.5$). Correcting for the angle of incidence in the TDI data does not account for the difference in strain ($r = -0.2, p = 0.05$).

Discussion: We conclude that since STE with TEE is not dependent on interrogation angle it allows measurement of sequential contraction by strain more reliably than TDI. These data suggest that STE can be used to evaluate the Helical Band theory of myocardial function, wherein a bi-layered arrangement of fibers is proposed in the interventricular septum. Moreover, these data suggest that a traditional 20 degree tolerance for tissue Doppler may be unacceptably high because measured strain becomes radial rather than longitudinal at higher angles of incidence.

References:

1. Buckberg, G.D., et al., Structure/function interface with sequential shortening of basal and apical components of the myocardial band. *Eur J Cardiothorac Surg*, 2006. 29 Suppl 1: p. S75-97.
2. Teske, A.J., et al., Echocardiographic quantification of myocardial function using tissue deformation imaging, a guide to image acquisition and analysis using tissue Doppler and speckle tracking. *Cardiovasc Ultrasound*, 2007. 5: p. 27.

SCA31

REAL TIME THREE-DIMENSIONAL INTRAOPERATIVE TRANSESOPHAGEAL ECHOCARDIOGRAPHY FOR EVALUATING MITRAL VALVE PATHOLOGY

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Background: Intraoperative transesophageal echocardiography (TEE) is an important diagnostic tool for evaluating the mechanism of mitral valve (MV) dysfunction. Three-dimensional (3D) TEE provides novel imaging windows which may improve the accuracy of diagnosing MV pathology. This study compared images of MV pathology acquired with a novel real-time 3D Matrix TEE transducer (RT-m3D TEE; Philips Medical Systems, Andover, MA) with standard two-dimensional (2D) images in cardiac surgical patients undergoing MV repair.

Methods: Comprehensive intraoperative 2D and RT-m3D TEE examinations were performed in patients undergoing MV surgery. Detailed diagnoses of the mechanism of MV dysfunction and location by leaflet scallop were determined by experienced echocardiographers, from images acquired with each technique, and were compared with the surgeons description.

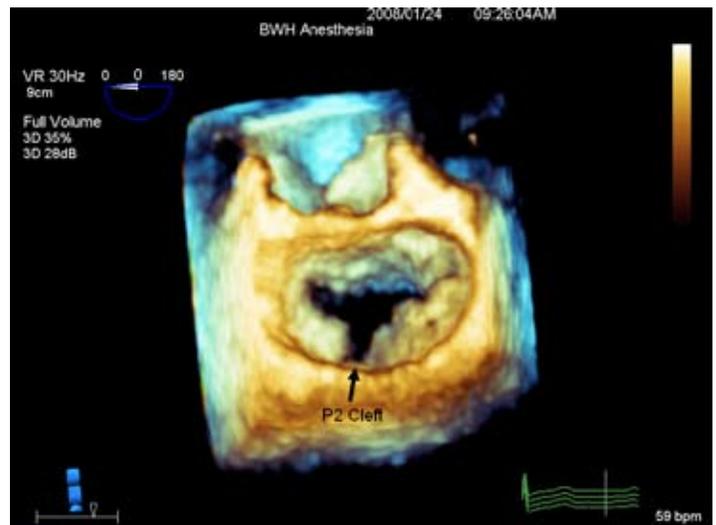
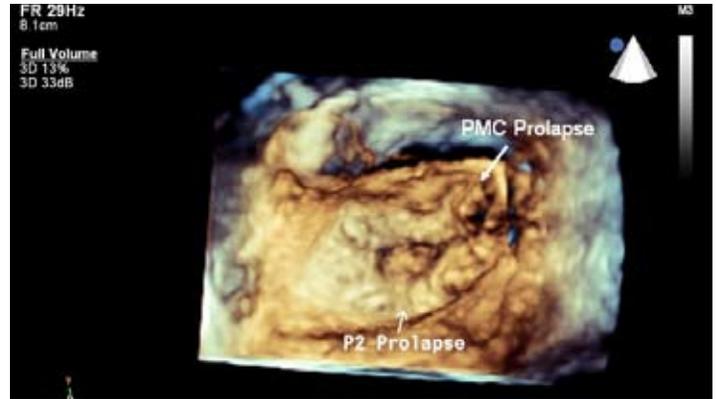
Results: 59 patients with various preoperative diagnoses of MV pathology (Table 1) were evaluated. By using surgical inspection as the gold standard, 2D TEE imaging correctly identified the mechanism and specific location of MV leaflet pathology in 47 cases (80%). Incorrect 2D TEE diagnoses occurred in 12 cases (20%), primarily in patients with mixed lesions including commissural pathology (N=5; Figure 1 and leaflet clefts (N=7; Figure 2). RT-m3D TEE imaging correctly identified the mechanism and specific location of MV leaflet pathology in 56 cases (95%). Incorrect RT-m3D TEE diagnoses were made in 3 cases (5%). Two of these latter patients were misdiagnosed with perforations in lateral and medial posterior scallops, and 1 patient had a single ruptured chord in the medial anterior leaflet scallop which was missed.

Conclusion: Compared to standard 2D TEE imaging, intraoperative RT-m3D TEE is more accurate in defining the mechanism of MV dysfunction and location by leaflet scallop. Thus, RT-m3D TEE may be more beneficial in facilitating perioperative surgical planning for MV repair, especially in patients with complex mitral pathology.

Table 1. Preoperative Diagnosis of Mitral Valve Dysfunction (N=59)

Mechanism of Mitral Valve Dysfunction (N)
 Dilated Annulus (9)
 Leaflet Prolapse or Flail (33)
 Functional Mitral Regurgitation (10)
 Rheumatic Valve Disease (4)
 Endocarditis (3)

Figure 1. RT-m3D TEE image demonstrating a mixed lesion of the mitral valve, including a posterior leaflet middle scallop prolapse (P2) and posterior medial commissural (PMC) prolapse. Figure 2. RT-m3D TEE image demonstrating a posterior leaflet middle scallop (P2) cleft.



SCA32

THE HELICAL BAND THEORY OF MYOCARDIAL FUNCTION IS SUPPORTED BY SPECKLE TRACKING WITH INTRAOPERATIVE TEE DURING CARDIAC SURGERY

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Introduction: The Helical Band theory of mechanical myocardial function has been proposed to explain right and left as well as systolic and diastolic ventricular function as a consequence of the sequential transmural contraction of the descending then ascending segments [1]. Many modalities including MRI, nuclear imaging and echocardiography with strain have been used to test this theory. Few studies, however, have used transesophageal echocardiography (TEE) in human subjects. We tested the hypothesis that intraoperative TEE coupled with Speckle Tracking Echocardiography (STE) would enable mechanistic insights into this theory.

Methods: After IRB approval and informed consent, 21 patients undergoing CABG surgery were evaluated. The 4 chamber long axis image was acquired with TEE imaging post induction and pre initiation of cardiopulmonary bypass. Analysis of time to peak systolic strain along the intraventricular septum at three segments (base, mid, apex) was performed. The paired t-test was used to determine a difference between base and apex and simple linear regression was used to model sequential time to peak systolic strain between segments. $P < 0.05$ was considered significant. Statistical analysis was performed using E-guide 4/SAS 9.1 software. All image analysis was done off-line with EchoPac software (GE, Milwaukee, WI).

Results: Among the segments studied, 59 out of 63 were available for analysis. The paired t-test found a significantly longer time to peak systolic strain in the apex than the base (mean 49.4 ± 76.4 msec, 95% CI 10 - 88.7 msec).

The results from linear regression modeling of the time to peak strain for the three segments of the septum are displayed in Figure 1. The linear regression model was significant ($p=0.04$) and showed a base-to-apex sequence for time to peak strain with the regression coefficient of 21.9 ms per segment.

Discussion: We conclude that a sequential development of peak strain from the intraventricular base to the apex exists. This time of sequential contraction is consistent with typically measured QRS duration. These data support the Helical Myocardial Band theory which posits that, although electrical activation spreads down the Purkinje system to the apex then back to the base, transmural contraction and blood flow is from base to apex following the descending loop.

References:

- Buckberg, G.D., et al., Structure/function interface with sequential shortening of basal and apical components of the myocardial band. *Eur J Cardiothorac Surg*, 2006. 29 Suppl 1: p. S75-97.

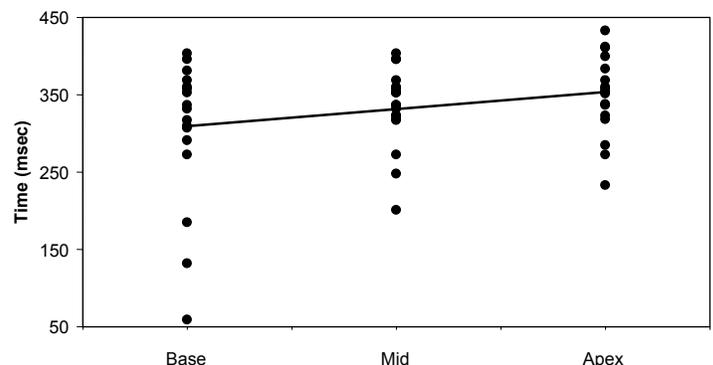


Figure 1. Linear regression of time to peak systolic strain by segment

SCA33

THE POSTOPERATIVE ELECTROCARDIOGRAM IS NOT PREDICTIVE OF ADVERSE CARDIAC EVENTS FOLLOWING CORONARY ARTERY BYPASS GRAFT SURGERY

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Background:

Myocardial infarction (MI) in the ambulatory population is usually diagnosed with a combination of clinical symptoms, elevated myocardial biomarkers and electrocardiogram (ECG) pattern. However, the definition of perioperative MI (PMI) after cardiac surgery may be challenging because of a high frequency of indeterminate diagnostic ECG findings, routine elevation of cardiac biomarkers after uncomplicated cardiac surgery to levels that are considered as diagnostic of MI in the ambulatory population, and further elevation of cardiac biomarkers in response to myocardotomy for cannulation or valve surgery. In the absence of a true gold-standard for PMI, we investigated the utility of traditional ECG and cardiac biomarker criteria to predict clinically relevant myocardial injury defined as increased hospital length of stay (HLOS) and mortality.

Methods:

Preoperative and postoperative ECGs and biomarkers (B-type natriuretic peptide (BNP), the MB fraction of creatine kinase (CKMB), cardiac Troponin (cTnI) drawn preop, after cardiopulmonary bypass (CPB) and on postoperative days (POD) 1-5), were assessed in 939 patients undergoing primary coronary artery bypass grafting (CABG) with CPB. After excluding patients with recent MI (<2 wks) by clinical history, prior MI on the preoperative ECG, missing ECG or biomarker data, or reoperation, 550 patients remained. PMI on ECG was classified by a cardiologist using the Minnesota criteria. HLOS and all cause mortality up to 5 years after surgery were applied as adverse cardiac outcomes to define clinically relevant PMI. Separate multivariate clinical models for each outcome were prepared in a stepwise fashion using significant univariate and demographic predictors. A Cox proportional-hazards model was used to estimate the independent prognostic utility of ECG and cardiac biomarkers on HLOS and mortality while adjusting for baseline demographic characteristics and perioperative risk factors. Risk ratios (RR) are expressed as a 10-fold change. Nested model comparisons were tested with the likelihood ratio test.

Results:

The incidence of PMI by ECG was 21.1%. On univariate analysis, an ECG diagnosis of PMI was associated with a small increase in mean POD1 cTnI (6.24 ng/ml, 95%CI 4.7-7.8, vs. no PMI, 3.1 ng/ml, 95%CI 2.2-3.9; P=0.04), but not CKMB or BNP. When added to the clinical model for either HLOS or mortality, an ECG diagnosis of PMI did not significantly improve model performance. The log-normalized cTnI level on POD1 was the only independently predictive biomarker of mortality (RR=2.2; 95%CI, 1.01-4.42; P<0.05) and extended HLOS (RR=1.2; 95% CI, 1.02-1.54; P<0.05). Furthermore, the addition of one or more of the predictors BNP, CKMB or ECG did not provide additional prognostic power over cTnI on POD1.

Conclusion:

An ECG diagnosis of MI after cardiac surgery is not associated with an increased risk of death or extended HLOS. Conversely, cTnI elevation on POD1 is independently associated with an increased mortality and prolonged HLOS, even after accounting for established clinical risk predictors of PMI and other biomarkers.

SCA34

ASSESSMENT OF LEFT VENTRICULAR FUNCTION USING SPECKLE TRACKING ECHOCARDIOGRAPHY DURING VASOPRESSOR-INDUCED INCREASES IN AFTERLOAD IN A RABBIT MODEL.

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Background:

Speckle tracking echocardiography (STE) is a recently developed method of analyzing 2-dimensional echocardiography images to quantify various parameters of cardiac deformation. Strain and strain rates can be determined; the twisting motion of the left ventricle (LV) during the cardiac cycle can also be quantified. These non-invasively derived parameters provide novel insights into cardiac function. This study seeks to evaluate the impact of increasing afterload on STE derived parameters of global function in comparison with hemodynamic indices derived by invasive instrumentation. Specifically, we studied in a rabbit model, the effects of incremental doses of different vasoconstrictors on cardiovascular function.

Methods:

Five (n=5) anesthetized rabbits underwent midline sternotomy and placement of intraventricular pressure-volume conductance catheters. Epicardial echocardiographic images and left ventricular (LV) pressure-volume (PV) loops were acquired for offline analysis at baseline and during norepinephrine, phenylephrine and vasopressin infusion at low, middle, and high concentrations. PV data analysis included end systolic pressure volume relationships (ESPVR), total peripheral resistance (TPR), Tau, dP/dt, end diastolic/systolic volumes (EDV/ESV), end systolic pressure (ESP), cardiac output (CO). High-resolution 2-D echocardiographic images were analyzed for apical and basal twist, apical average and peak twist rate (TR), apical peak untwist rate (UR) as well as global circumferential strain and strain rate at the mid-papillary level.

Results:

TPR was observed to increase along with a 35- 50% increase in ESP, while heart rate significantly decreased and CO was reduced during infusion of the vasoconstrictors. These effects were most pronounced with vasopressin. An increase in dP/dt and E-max with norepinephrine and a decrease with vasopressin at escalating doses was detected ($p<0.05$). Apical twist and average twist rate were preserved during the norepinephrine infusion (11.9 ± 2 vs 12.3 ± 2), while medium and high doses of vasopressin demonstrated decreases (6.3 ± 1) ($p<0.05$). Strain were unchanged with norepinephrine with reductions at escalating doses of vasopressin ($p<0.05$).

Conclusions:

2-D Speckle tracking echocardiography provides clinicians a powerful tool for analyzing the cardiac deformation, which can provide novel non-invasive ways to assess of cardiac function in various physiologic and pathologic states. This study demonstrates the impact of pharmacologic intervention on several STE derived parameters in comparison to invasively derived hemodynamic parameters of cardiac performance.

SCA35

DIASTOLIC DYSFUNCTION AND POSTOPERATIVE ATRIAL FIBRILLATION IN PATIENTS UNDERGOING CORONARY REVASCULARIZATION SURGERY

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INTRODUCTION: Atrial fibrillation (AF) occurs in 20-30% of patients undergoing coronary revascularization surgery and is associated with significant perioperative morbidity and mortality.[1-2] During coronary artery bypass graft surgery (CABG), left ventricular (LV) diastolic dysfunction (DD) is a frequent occurrence.[3] The echocardiographic predictors of perioperative DD are not well defined. This study investigates a relationship between the perioperative DD and a new onset of AF.

METHODS: Following REB approval, an informed consent was obtained from 72 patients undergoing elective CABG surgery. A complete transesophageal echocardiographic examination (TEE) was performed after induction of anesthesia and after surgical revascularization. The following measures were recorded in all patients: mitral valve inflow (e and a wave velocities, a/e ratio, deceleration time, a duration), pulmonary venous flow (s and d wave velocities, s/d ratio, duration of atrial reversal), mitral annular tissue doppler velocities (a and e wave velocities, e/a ratio). DD was assessed off-line by two independent investigators. DD was classified in three patterns (impaired relaxation, pseudo-normal and restrictive) according to the previously published guidelines.[4] The primary outcome was to assess if the presence of DD is associated with increased risk of postoperative AF.

RESULTS: 18 of 72 patients (25%) developed post-operative AF. Age, gender, co-existing diseases, number of grafts and duration of cardiopulmonary bypass were similar in the patients with and without DD. DD at baseline was not associated with increased risk of postoperative AF ($p=0.20$). Worsening of DD after revascularization was associated with a higher incidence of postoperative AF (Figure, $p=0.035$).

DISCUSSION: Worsening of DD after coronary revascularization should be considered as a risk factor for new onset AF after CABG surgery.

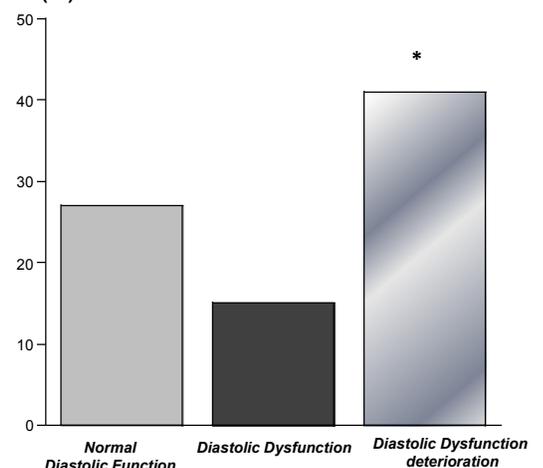
REFERENCES: [1] J Am Coll Cardiol 2001;37:371-380, [2] J Am Coll Cardiol 1998;32: 695-703, [3] J Thorac Cardiovasc Surg 1997;114:254-60,[4] J of Am Soc Echocardiogr 1996;9:736-760.

Table

	Normal Diastolic function	DD Unchanged	DD Worsened
Number	34	26	12
LV pre	1.6 ± 0.85	1.3 ± 0.8	1.4 ± 0.17
LV post	1.6 ± 0.78	1.3 ± 0.62	1.4 ± 0.52
Age	57 ± 1.7	61 ± 2	60 ± 3
CPB	87 ± 22	86 ± 26	88 ± 32
CCT	71 ± 20	70 ± 21	68 ± 28
HLOS	6.8 ± 2.3	7.2 ± 2.7	7 ± 2.7
AF	9	4	5

DD: diastolic dysfunction; LV: left ventricle; CPB: cardio-pulmonary bypass; CCT: clamping time; HLOS: hospital length of stay; AFIB: atrial fibrillation

Atrial Fibrillation (%)



SCA36

PROGNOSTIC VALUE OF PERIOPERATIVE TROPONIN I LEVELS FOR PREDICTING CARDIOVASCULAR COMPLICATIONS FOLLOWING CARDIAC SURGERY IN POSTMENOPAUSAL WOMEN

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BACKGROUND: Perioperative mortality and morbidity secondary to cardiovascular complications following cardiac surgery has been consistently shown to be higher for women than men. Troponin I is a sensitive marker for cardiac injury, however the levels may vary between the sexes following cardiac surgery. The purpose of this study was to evaluate the prognostic value of troponin I levels for predicting cardiovascular complications in postmenopausal women undergoing cardiac surgery and to evaluate whether myocardial injury is modulated by 17 b-estradiol.

METHODS: In a double-blind study, 175 postmenopausal women (not receiving estrogen replacement therapy) undergoing coronary artery bypass grafting (with or without valve surgery) were prospectively randomized to receive 17b-estradiol or placebo for seven days perioperatively. Serial 12-lead ECGs and serum troponin I levels were measured before surgery, immediately following surgery, and daily through postoperative day 4.

RESULTS: Measured troponin I levels on postoperative day one were highly predictive of Q-wave myocardial infarction, low cardiac output state (cardiac index < 2.0 L/min/m² for > 8 hours) and operative death (area under the ROC=0.862). A cut-off point for troponin I of >7.6 ng/mL provided the optimal sensitivity and specificity for identifying postmenopausal women at risk for adverse cardiovascular events following cardiac surgery. The negative predictive value of a troponin I level for identifying a patient with a composite cardiovascular outcome was high (96%) while the positive predictive value was moderate (40%)(Table 1). In comparison to placebo, postoperative troponin I levels were not modulated by perioperative 17 b-estradiol administration.

CONCLUSIONS: In postmenopausal women undergoing cardiac surgery, elevated troponin levels on postoperative day one are highly predictive of adverse cardiovascular events. In addition, the cut-off point for troponin I levels predictive of an adverse cardiovascular complication may be lower in women than previously reported for mixed gender populations which have been largely composed of men. Routine monitoring of perioperative troponin I levels may provide a means for risk stratification of patients at high risk for adverse cardiovascular outcome.

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2. Koch CG, Khandwala F, Nussmeier N, Blackstone EH. Gender and outcomes after coronary artery bypass grafting: A propensity-matched comparison. *J Thorac Cardiovasc Surg* 2003;126:2032-43.
3. Adams JE 3rd, Bodor GS, Dávila-Román VG, et al. Troponin I: A marker with high specificity for cardiac injury. *Circulation* 1993;88:101-6.

Table 1. The predictive capacity of troponin I measured on postoperative day one for identifying risk for a major adverse cardiovascular event (MACE) consisting of postoperative Q-wave myocardial infarction (MI), low cardiac output state*, or death within 30 days of surgery. Values in parenthesis are 95% confidence interval.

Troponin I Threshold	7.6 ng/ml
Sensitivity	82% (62%, 94%)
Specificity	77% (70%, 84%)
Positive Predictive Value	40% (27%, 54%)
Negative Predictive Value	96% (90%, 99%)
P-Value for Model	< 0.001
Area under ROC	0.862
Hosmer-Lemshow P-Value	0.146

*Low cardiac output was defined as cardiac index < 2.0 L/min/m² for > 8 hours regardless of treatment.