Coronary Artery Bypass Graft: Monitoring Patients and Detecting Complications

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Division of Cardiothoracic Anesthesia & Critical Care
Duke University School of Medicine

DukeHealth

@mswami001 #EchoHawaii

Disclosures

- None

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What we will talk about

1. Why we need echo in CABG
2. What to look for with echo
3. When to look

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Audience Question 1

How often do you use (or advocate for) TEE in CABG cases?

1. Always
2. Frequently (more than 50% cases)
3. Sometimes (25-50%)
4. Rarely (< 25; > 0%)
5. Never

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Outline

- Monitoring before CABG
- Monitoring needs after CABG
- Looking out for complications

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Before CABG

These specific procedural indications include the use of TEE in selected cardiac operations (i.e., valvular procedures) and thoracic aortic surgical procedures as well as use in **some coronary artery bypass graft surgeries…**

ASE GUIDELINES AND STANDARDS

Guidelines for Performing a Comprehensive Transesophageal Echocardiographic Examination: Recommendations from the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists

…it is the recommendation of the writing committee that a physician trained in basic PTE echocardiography use … views for a more comprehensive evaluation and for monitoring of global and regional LV function.

EXPERT CONSENSUS STATEMENT

Basic Perioperative Transesophageal Echocardiography Examination: A Consensus Statement of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists

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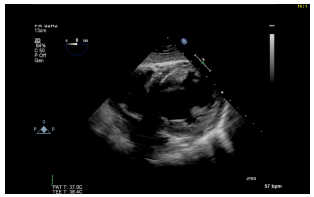
Before CABG

1. Contractility
2. Wall motion
3. Diastolic function
4. Associated issues



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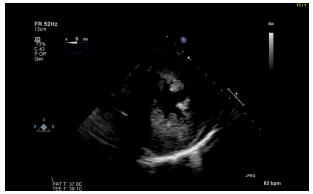

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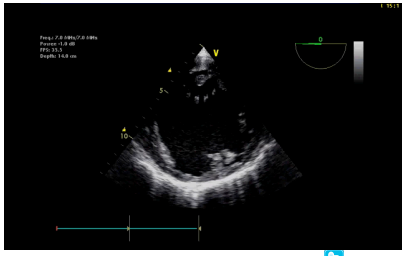

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Before CABG

Transesophageal echocardiography interpretation: a comparative analysis between cardiac anesthesiologists and primary echocardiographers.
Mathew, JP et al. Anesth Analg. 2002 Feb;94(2):302-9

1. Contractility
2. Wall motion
3. Diastolic function
4. Associated issues

- ☑ 154 exams by 10 anesthesiologists
- ☑ Offline validation by cardiologist and radiologist
- ☑ Percent agreement
  - A vs R = 83%
  - A vs. C = 80%
  - C vs. R = 82%

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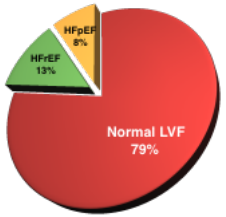
Before CABG

Comparison of 5-Year Outcomes After Coronary Artery Bypass Grafting in Heart Failure Patients With Versus Without Preserved Left Ventricular Ejection Fraction (CREDO-Kyoto CABG Registry Cohort-2)
Marui et al.Am J Cardiol. 2015 Aug 15;116(4):580-6.

1. Contractility
2. Wall motion
3. Diastolic function
4. Associated issues

- 1,877 CABG cases



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Before CABG

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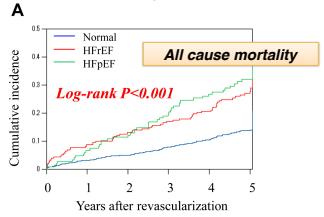

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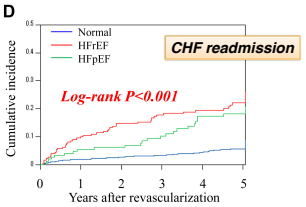

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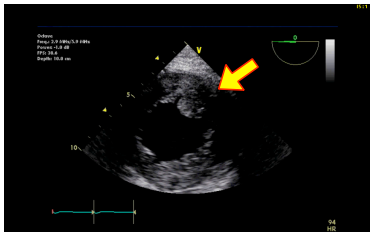

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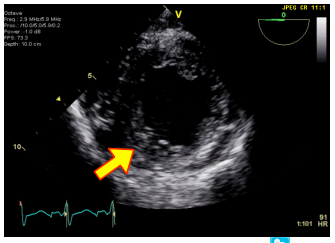

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Before CABG

Deterioration of Regional Wall Motion Immediately after Coronary Artery Bypass Graft Surgery Is Associated with Long-term Major Adverse Cardiac Events

Anesthesiology 2007; 107: 739-45

1. Contractility
2. Wall motion
3. Diastolic function
4. Associated issues

- 1,412 CABG cases
- Wall motion graded before and after revascularization
- Wall motion score derived
- Change in WMS categorized as improvement/ deterioration or no change
- Association with MACE for up to 2 years assessed

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Before CABG

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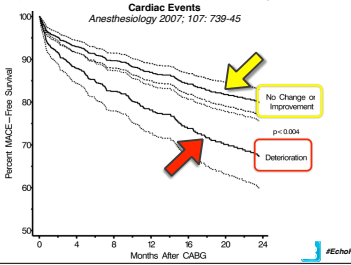

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Audience Question 2

Which of the following best describes your perception of intraoperative diastolic function assessment?

1. Contractility
2. Wall motion
3. Diastolic function
4. Associated issues

1. It doesn't matter
2. It matters, but I don't know how to measure it
3. I can measure, but I don't know what to do about it
4. I care, but no one else does

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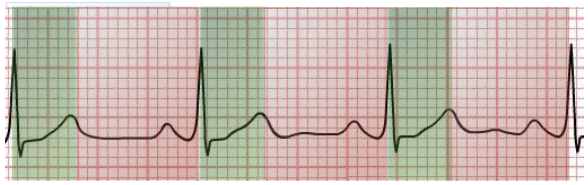
Audience Question 2

Which of the following best describes your perception of intraoperative diastolic function assessment?



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Before CABG

1. Contractility
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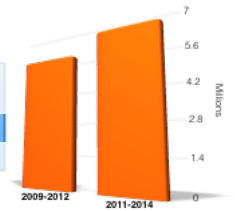
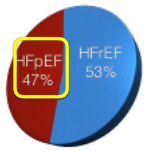


Prevalence

Heart Failure with **Preserved** Ejection Fraction



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AHA Heart Disease and Stroke Update 2017

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Before CABG

1. Contractility
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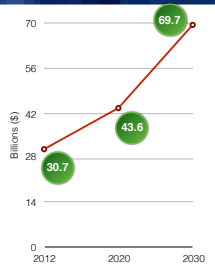

AHA Heart Disease and Stroke Update 2017

Before CABG

Prognostic impact of diastolic dysfunction in systolic heart failure:
A cross-project analysis from the German Competence Network Heart Failure

1. Contractility
2. Wall motion
3. Diastolic function
4. Associated issues

- 1,046 patients
- s-SD=EF<35%
- s-DD=E/e'>15

Clinical Cardiology
3 MAY 2017 DOI: 10.1002/clc.22710
http://onlinelibrary.wiley.com/doi/10.1002/clc.22710/full#clc22710-fig-0001

Before CABG

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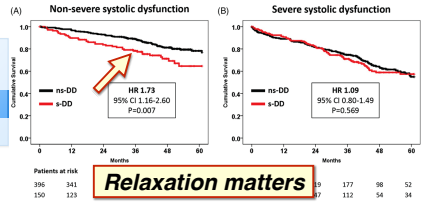

1. Contractility
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4. Associated issues

Relaxation matters

Clinical Cardiology
3 MAY 2017 DOI: 10.1002/clc.22710
http://onlinelibrary.wiley.com/doi/10.1002/clc.22710/full#clc22710-fig-0001

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Before CABG

Effect of diastolic dysfunction on postoperative outcomes after cardiovascular surgery: A systematic review and meta-analysis.
Kaw et al. JTCVS. 2016;152(4):1142-53

Diastolic dysfunction in patients undergoing cardiac surgery: a pathophysiological mechanism underlying the initiation of new-onset post-operative atrial fibrillation.
Melduni et al. J Am Coll Cardiol. 2011;58:953-61

Effect of diastolic dysfunction on early outcomes during elective off-pump coronary artery bypass grafting: a prospective observational study.
Youn et al. Ann Thorac Surg. 2011;92:587-93

Prognostic value of a tissue Doppler-derived index of left ventricular filling pressure on composite morbidity after off-pump coronary artery bypass surgery.
Jun et al. Br J Anaesth 2011;107:519-24

Prognostic implications of preoperative E/e' ratio in patients with off-pump coronary artery surgery.
Lee et al. Anesthesiology. 2012;116:362-71

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Before CABG

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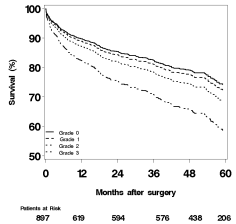
Utility of a simple algorithm to grade diastolic dysfunction and predict outcome after coronary artery bypass graft surgery
Swaminathan, et al Ann Thorac Surg 2011; 91(6):1844-50



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Before CABG

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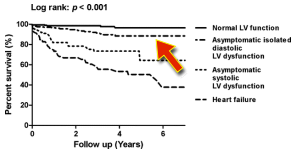
Prognostic implications of asymptomatic left ventricular dysfunction in patients undergoing vascular surgery.
Flu et al. Anesthesiology. 2010 Jun;112(6):1316-24

- Vascular surgery (n=1,005)
- E/A ratio, EDT, PV flow
- Isolated LVDD associated with 30-day and long-term adverse cardiac outcomes



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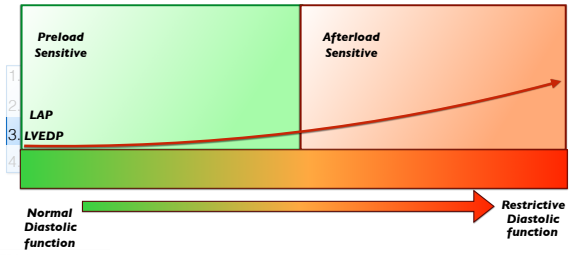
Before CABG



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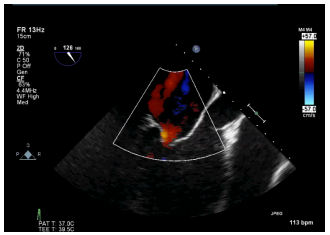

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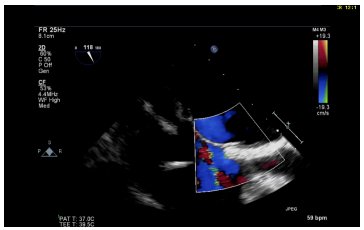

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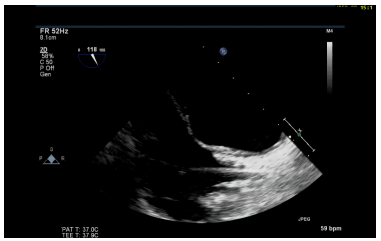

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Outline

- Monitoring before CABG
- Monitoring needs after CABG
- Looking out for complications

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Outline

- Monitoring before CABG
- Monitoring needs after CABG
- Looking out for complications

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After CABG

1. Air
2. Dissection
3. Stunning

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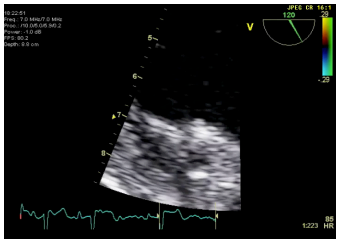
After CABG



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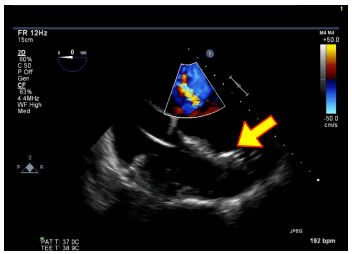

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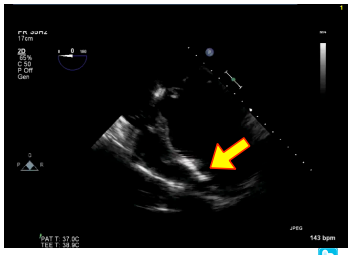

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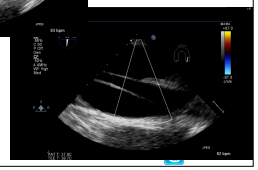

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After CABG

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Original Article

ASIAN ANNALS

Asian Cardiovascular & Thoracic Annals
2015, Vol. 23(1) 31–35
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DOI: 10.1177/0218492314531140
asa.sagepub.com

SAGE

Iatrogenic intraoperative type A aortic dissection following cardiac surgery

Pradeep Narayan, Gianni D Angelini and Alan J Bryan

- 15,144 consecutive cases
- All cardiac surgery
- 0.04% incidence
- TEE recommended since mortality risk is high if detected late

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After CABG

ORIGINAL ARTICLE

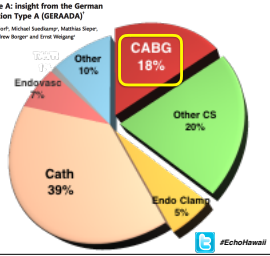
Winner of the 2012 EACTS Young Investigator Award–Cardiac

Iatrogenic acute aortic dissection type A: insight from the German Registry for Acute Aortic Dissection Type A (GERAADA)

Bartosz Rylski*, Isabell Hoffmann, Friedhelm Beyersdorf, Michael Suedkamp, Matthias Siepe, Brigitte Nitsch, Maria Blettner, Michael Andrew Borger and Ernst Wolgang

1. Air
2. Dissection
3. Stunning

- 2,137 cases of Type A aortic dissection
- 100 cases were iatrogenic (4.7%)



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After CABG

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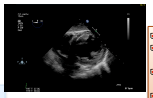

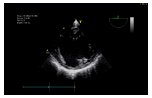

- Contact with circuit
- Alteration of hemostatic balance
- Pro inflammatory cytokines
- Disturbed calcium homeostasis
- Mitochondrial cytochrome release
- Free O2 release

- Neutrophil activation
- Pro inflammatory cytokines

- Myocyte loss
- Contractile dysfunction

Cardioplegia

Incision | CPB | Close

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After CABG

1. Air
2. Dissection
3. Stunning

Predictors of inotrope use during separation from cardiopulmonary bypass.
McKinlay KH, et al. J Cardiothorac Vasc Anesth. 2004 Aug;18(4):404-8.

- 1,009 patients undergoing CABG
- Intra-op TEE done in all cases
- Inotrope use defined as dopamine (>5), epi, norepi, milrinone or dobutamine
- 6 independent predictors of inotrope use
  1. ***Wall motion score index***
  2. ***Combined CABG and MVR***
  3. ***LVEF < 35%***
  4. ***Redo surgery***
  5. ***Mod-severe MR***
  6. ***Aortic cross clamp time***

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After CABG

1. Air
2. Dissection
3. Stunning

Predictors of inotrope use in patients undergoing concomitant coronary artery bypass graft (CABG) and aortic valve replacement (AVR) surgeries at separation from cardiopulmonary bypass (CPB).
Ahmed I, et al. J Cardiothorac Surg. 2009 Jun 12;4:24.

- 97 patients undergoing CABG AVR
- Intra-op TEE done in all cases
- Inotrope use defined as dopamine, epi, norepi, milrinone or dobutamine
- 4 independent predictors of inotrope use
  1. ***Cardiac index < 2.5L/min/m2***
  2. ***LVEDP > 20 mm Hg***
  3. ***LVEF < 40%***
  4. ***CKD stage 3-5***

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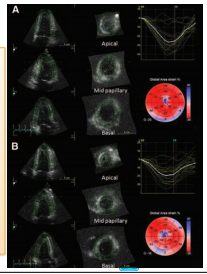
After CABG

Preoperative Three-Dimensional Strain Imaging Identifies Reduction in Left Ventricular Function and Predicts Outcomes After Cardiac Surgery.
Howard-Quijano K, et al. Anesth Analg. 2017;124(2):419-428

1. Air
2. Dissection
3. Stunning

- 163 patients undergoing CABG (n=50), AVR and MVR
- TTE done preop - including 3D speckle tracking
- 3D EF was reduced after cardiac surgery: Less in CABG
- Patients with EF < 45%
  - 3D- GCS, GRS - were predictive of worse outcomes and
  - 2D-GLPS and GLCS were also predictive of increased inotrope requirements



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Points to ponder…

- Should we do TEE routinely in all CABG?
- If yes, is it justifiable?
- If not, how should we select cases?

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Who does TEE in CABGs?

- 200 centers
- 27 countries

Multinational Institutional Survey on Patterns of Intraoperative Transesophageal Echocardiography Use in Adult Cardiac Surgery

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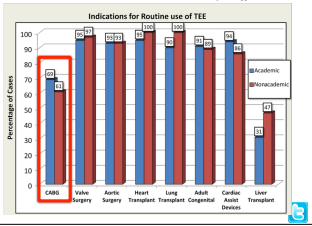

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Points to ponder…

I don't know. It depends…

- Should we do TEE routinely in all CABG?
- If yes, is it justifiable? ***I think it is***
- If not, how should we select cases?

1. 'High risk'
2. Likelihood of concurrent procedure
3. Resource availability

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Key Points

- Intraoperative TEE not recommended for routine use in all CABG surgery in several documents
- Invaluable for monitoring and treatment of hemodynamic disturbances
- Complications are infrequent, but can be costly

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Thank you

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