

The Cardiac Patient for Non-Cardiac Surgery

Brent Dunworth, CRNA, MSN, MBA

VANDERBILT UNIVERSITY MEDICAL CENTER

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### Learning Objectives

-  Review the principles and management goals to prevent cardiovascular perioperative morbidity.
-  Describe common patient presentations that require a customized approach to anesthetic management.
-  Recite contemporary practice management strategies for patient with low output states, implantable devices, and transplant recipients

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### Estimating Risk

PREOPERATIVE EVALUATION

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**Question**

What percentage of adult surgical patients have or are at-risk for CAD?

A) 10%  
 B) 20%  
 C) 40%  
 D) 50%

Adult Surgical Patients

A pie chart titled "Adult Surgical Patients" is divided into two segments. The larger, grey segment represents "No CAD Risk, 60%". The smaller, red segment represents "CAD Risk, 40%".

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**Estimating Risk**

40% of adult surgical patients will either have or be at risk for CAD.

Silent Risk: new Q-wave on ECG or new wall-motion abnormality on echo

- 40% of women
- 30% of men

Arora V et al. Preoperative assessment of cardiac risk and perioperative cardiac management in noncardiac surgery. Int J Surg 9:23, 2011.

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An ECG tracing on a standard grid. Lead II shows a new Q-wave, which is circled in red. Other leads (I, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6) are also visible, with some minor changes noted in leads III, V1, V2, and V3.

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# Guiding Principles

**2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery**

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines

<http://content.onlinejacc.org/article.aspx?articleid=1893784>




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Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Journal of the American College of Cardiology. 2014;62(25):e177-e137.




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# Perioperative Approach to Cardiac Assessment



Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Journal of the American College of Cardiology. 2014;62(25):e177-e137.




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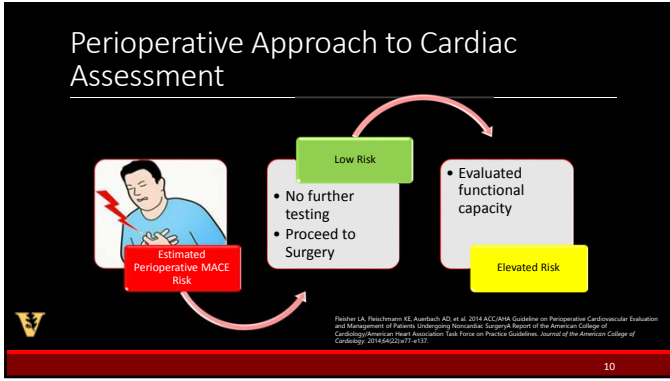
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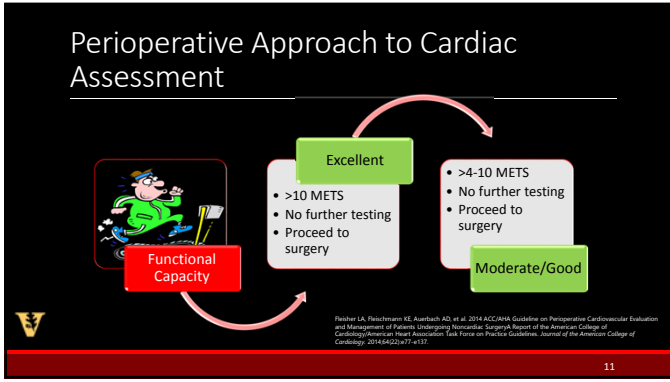
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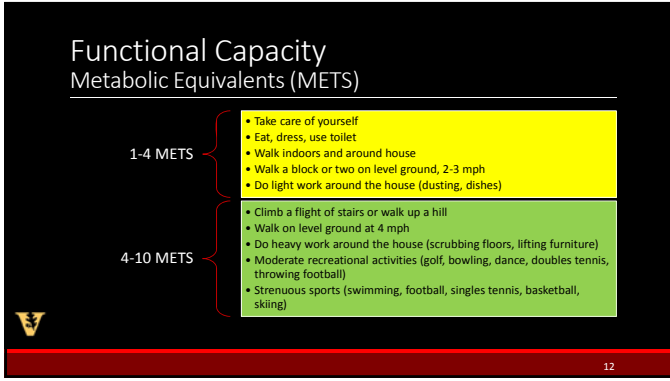
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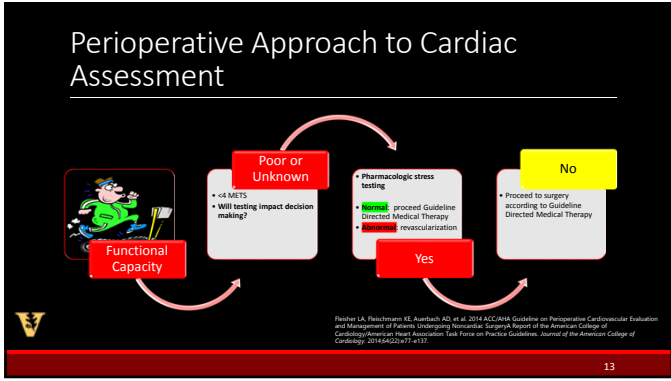
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### Estimating Risk

1. Clinical Markers

- Known CAD
- Previous heart failure
- Diabetes
- Renal insufficiency (Cr > 2 mg/dL)

Number of markers	Risk of infarct or death
1-2	2%
≥3	8.5%

Arora V et al. Perioperative assessment of cardiac risk and perioperative cardiac management in noncardiac surgery. Int J Surg 9:23, 2011.

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### Estimating Risk

2. Functional Status

- Difficulty with ADLs
  - Much higher risk
- Poor "anaerobic threshold"
  - 18% risk of death
- Walk 4 blocks or climb 2 flights of steps
  - Risk for cardiac event doubled

Arora V et al. Perioperative assessment of cardiac risk and perioperative cardiac management in noncardiac surgery. Int J Surg 9:23, 2011.

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### Estimating Risk

3. Surgical Risk

LOW (<1%)	MODERATE (1-5%)	HIGH (>5%)
Orthopedic Urologic Breast Thyroidectomy Inguinal hernia	Bariatric Intraperitoneal Intrathoracic Head and Neck Prostate	Vascular Major thoracic Bariatric

Arora V et al. Preoperative assessment of cardiac risk and perioperative cardiac management of noncardiac surgery. Int J Surg 9:22, 2011.

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### Noninvasive Testing

Considerations

- Recent testing
- Concern for CAD, LV dysfunction, VHD
- Can patient exercise?

**Will Results Lead to a Change in Care?**

Conditions which dictate evaluation

- Unstable CAD
- Decompensated HF
- Symptomatic arrhythmias
- Severe VHD

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### Noninvasive Testing

Test	Positive Predictive Value	Negative Predictive Value
Thallium Imaging	12.5%	99%
Stress echocardiography	20%	99%

		Condition (as determined by "Gold standard")	
		Positive	Negative
Test Indication	Positive	True Positive (Type I error)	False Positive (Type II error)
	Negative	False Negative (Type II error)	True Negative

**Will Results Lead to a Change in Care?**

Ridgway ZA, Howell SJ. Cardiopulmonary reserve testing: a review of methods and applications in surgical patients. Eur J Anaesthesiol 27:656, 2010.

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**Preventing MACE**

CORONARY STENTS

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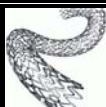
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**Coronary Stents**




**Bare Metal**

- Endothelialize after implantation
- Risk: acute thrombosis, first 6 weeks (major risk)
- Rx: dual antiplatelet therapy
  - Aspirin
  - Thienopyridine
    - Clopidogrel (Plavix)
    - Ticagrelor (Ticlid)

**Drug-Eluting**

- Limited endothelialization
- Limited restenosis
- Inferior risk of thrombosis
- Exposed stent struts
- Restenosis: risk never goes away
- Rx: dual antiplatelet therapy
  - Aspirin
  - Clopidogrel (Plavix), Ticagrelor (Ticlid)



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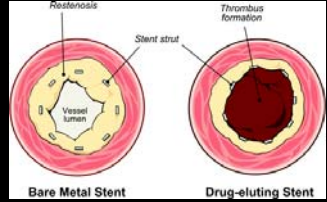
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**Thrombotic Risk**



**Bare Metal Stent**      **Drug-eluting Stent**

Restenosis      Thrombus Formation

Vessel Lumen      Stent strut

Neumann J, et al. Anesth Analg 2008; 107:552-560

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### Bare Metal Stents

Event Rate	Timeframe from Implantation
10.5%	<30 days
Very low	>30 days

### Drug-Eluting Stents

Event Rate	Timeframe from Implantation
6-8%	6-8 weeks
2.2%	3 months
<2%	6 months
1.6%	1 year

Neumann J, T et al. Anesth Analg 2008;107:552-569

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### Endothelialization of Stents

Neumann J, T et al. Anesth Analg 2008;107:552-569

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### Morbidity/Mortality

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    graph TD
      A[Abrupt discontinuation of clopidogrel and ASA] --> B[Rebound Effect]
      A --> C[Surgical Intervention]
      B --> D[Prothrombotic states]
      C --> E[Incomplete endothelialization]
      F[Stent Thrombosis] --> G[MI]
      F --> H[Death]
  
```

Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Journal of the American College of Cardiology. 2014;64(22):e77-e137.

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### Approach to Perioperative Management

- Bare metal stent
  - Delay elective surgery 6 weeks
- Drug-eluting stent
  - Delay elective surgery 1 year



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### Approach to Perioperative Management

*Evidence is growing... ACC/AHA 2014*

- Discontinuation of dual antiplatelet therapy
- Maintenance of dual antiplatelet therapy
- Discontinuation of thienopyridine



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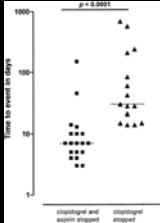

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### Cessation of Antiplatelet Therapy

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### Approach to Perioperative Management

Considerations

- Surgery
  - closed anatomical space
- Surgeon
- Risk/benefit
- Time since implantation
- Restart timeframe



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### Approach to Perioperative Management

Bridging therapy

- Short acting GP IIb/IIIa inhibitor
  - Abciximab (Reopro)
  - Eptifibatid (Integrilin)
  - Tirofiban (Aggrastat)
- Direct thrombin inhibitor
  - Agatroban
  - Lepirudin (Refludan)
  - Bivalarudin (Angiomax)



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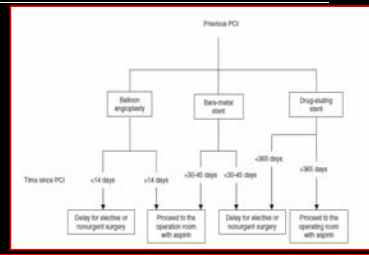
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### Approach to Perioperative Management



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### Question

Your patient presents to the preoperative evaluation clinic prior to elective shoulder arthroscopy. He has a history of MI, 9 months prior, with a drug-eluting stent placed. What is the best course of action?

- A) Continue with surgery and give sub-q heparin
- B) Consult cardiology
- C) Delay surgery by at least 3 months
- D) Continue with surgery and maintain dual antiplatelet therapy




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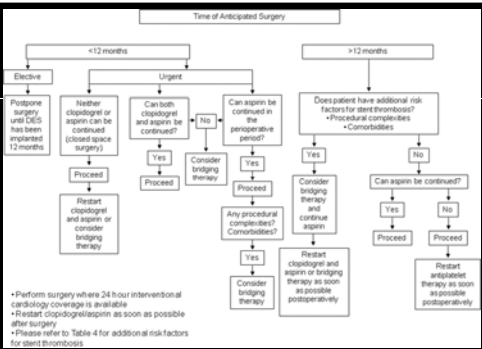
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- Perform surgery where 24 hour intervention at cardiology coverage is available
- Restart clopidogrel/aspirin as soon as possible after surgery
- Please refer to Table 4 for additional risk factors for stent thrombosis




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### Considerations

A FEW SCENARIOS

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## Regional Anesthesia

**ASRA Guidelines**

- Thienopyridines and dual antiplatelet therapy are contraindications to RA in noncompressible regions that cannot be monitored for bleeding
  - Clopidogrel: 7 day discontinuation
- Aspirin does **not** appear to increase risk of neuraxial anesthesia
- LMWH: 10-12 hour delay in RA
- UFH: platelet count to rule out HIT
- Bridging therapy (eptifibatid, tirofiban):
  - 8 hour delay in RA



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## Regional Anesthesia and Anticoagulants

Anticoagulant	Recommended Interval Between D/C of Drug and Pain Procedure	Recommended Interval Between Pain Procedure and Resumption of Drug
Coumadin	5 days + normalization of INR	24 hours
IV heparin	4 hours	2 hours**
SC heparin	8-10 hours	2 hours**
LMW heparin	24 hours	24 hours
Fibrinolytic agents	>48 hours*	>48 hours*
Fondaparinux	4 days	24 hours
Thienopyridine inhibitors	7 days	12-24 hours

\*lots are not stable until 10 days after fibrinolytic therapy  
\*\*if moderate or high-risk procedure (bloody), then 24 hours

Naruse S, Benson HT, Provenzano DA, et al. Interventional Spine and Pain Procedures in Patients on Antiplatelet and Anticoagulant Medication: Guidelines from the American Society of Regional Anesthesia and Pain Medicine, the European Society of Regional Anesthesia and Pain Therapy, the American Academy of Pain Medicine, the International Neuromodulation Society, the North American Neurocritical Care Society, and the World Institute of Pain. Regional Anesthesia and Pain Medicine. 2015;40(3):182-212.



<http://links.lww.com/AAP/A142>

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## Medication Management

### Beta Blockers

**Continue** beta blockers in patients who are on beta blockers **chronically**

It may be reasonable to begin perioperative beta blockers long enough in advance to assess safety and tolerability, **preferably >1 d before surgery**

Beta-blocker therapy should **not** be started on the day of surgery



Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Journal of the American College of Cardiology. 2014;64(25):e1-137.

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## Medication Management

**Statin**

- Continue statins in patients currently taking statins
- Perioperative initiation of statin use is reasonable in patients undergoing vascular surgery
- Perioperative initiation of statins may be considered in patients with a clinical risk factor who are undergoing elevated-risk procedures

Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACCAHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Journal of the American College of Cardiology*. 2014;64(22):e77-e137.

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## Device Management

Patients with ICDs should be on a cardiac monitor continuously during the entire period of inactivation, and external defibrillation equipment should be available. Ensure that ICDs are reprogrammed to active therapy

If surgical site is above the umbilicus, electrocautery interference is likely



Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACCAHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Journal of the American College of Cardiology*. 2014;64(22):e77-e137.

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## Heart Transplant

**Intact Frank-Starling mechanisms**

- Stroke volume does increase during demand making the patient "preload dependent"

**Autonomic denervation**


- Limits normal tachycardic and inotropic response to hypovolemia or hypotension
- Resting stroke volume, cardiac index are often normal
- No increased heart rate during demand

**Absence of cardiac vagal tone**

- Resting HR = 90-100
- Loss of bradycardic response to
  - Laryngoscopy, hypertension, carotid massage

**Inotropic or chronotropic therapy - DIRECT**

- Isoproterenol
- Epinephrine



Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACCAHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Journal of the American College of Cardiology*. 2014;64(22):e77-e137.

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