Management of Stable Ischemic Heart Disease

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Disclosure

No financial disclosure.
Outline of talk

• Overview of SIHD
• Diagnosis
  • Functional vs. Anatomic assessment
• Management
  • Medical Therapy
  • Lifestyle Modification
  • Coronary Revascularization (CABG vs. PCI)
  • Rapid Review of Key Studies
2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease


APPRIOPRIATE USE CRITERIA

ACC/AATS/AHA/ASE/ASNC/SCAI/SCCT/STS 2017 Appropriate Use Criteria for Coronary Revascularization in Patients With Stable Ischemic Heart Disease
Ischemic Heart Disease (Coronary Heart Disease)

• Results from inadequate blood supply to the myocardium, usually as a result of obstructive coronary atherosclerosis.

• IHD is “stable” if symptoms are manageable with medical or revascularization therapy.

• IHD is the leading cause of death worldwide.

• Over 16,500,000 Americans have IHD.
Clinical Manifestations

Angina Pectoris

1. Chest discomfort with characteristic quality and duration
2. Provoked by exertion or emotional stress
3. Relieved by rest or nitroglycerin

Fatigue          Dyspnea
Nausea           Epigastric Discomfort
Diagnosis

Functional Test

Exercise Stress Test

SPECT / PET Myocardial Perfusion Imaging

Stress Echo

Anatomic Test

Coronary Arteriography

Coronary CT Angiogram (CCTA)
Suspected Ischemic Heart Disease
(or change in clinical status in a patient with known IHD)

Intermediate or high-risk UA?†

Yes → See ACCF/AHA UA/NSTEMI Guideline

No → Symptoms or findings suggest high-risk lesion(s)‡

                  OR
Prior sudden death or serious ventricular arrhythmia

                  OR
Prior stent in unprotected left main coronary artery

Comprehensive clinical assessment of risk, including personal characteristics, coexisting cardiac and medical conditions, and health status

Technically adequate?  Yes → Recent exercise or cardiac imaging study

No → Contraindications to stress testing?

No → Patient able to exercise?

Yes → Previous coronary revascularization?

No → Resting ECG interpretable?

Yes → Initiate Guideline-Directed Medical Therapy

Go to Figure 4

Low likelihood IHD

Intermediate to high likelihood IHD

Intermediate to high likelihood IHD

Low likelihood IHD

Intermediate to high likelihood IHD

Intermediate to high likelihood IHD

Pharm stress MPI or Echo

Pharm CMR or CCTA

MPI or Echo w/ exercise

Standard exercise ECG

Standard exercise ECG

MPI or Echo w/ exercise or pharm CMR

CCTA

Test results suggest high-risk coronary lesion(s)?
Choosing a Diagnostic Test

- If a patient is able to exercise, they should. Pharmacologic testing should be reserved for patients with functional limitations.
- Consider adding imaging to a functional test (SPECT or ECHO)
  - When the EKG has abnormalities limiting interpretation during stress
  - When the patient has clinical characteristics that may result in greater diagnostic yield (e.g. diabetes)
- CCTA is a reasonable alternative to functional testing that has been shown to provide comparable clinical outcomes when utilized as an initial diagnostic test
  - Strength lies in its high NPV, good for “ruling out” CAD in patients with low-to-intermediate pre-test probability
Medical Management
2 Primary Goals for Medical Therapy of SIHD

Prevent Death and MI (Disease Modification) → Improve “Quantity of Life”

Reduce Angina and Relieve Ischemia → Improve “Quality of Life”
Medical Therapy to Improve Prognosis
“Quantity of Life”

- Antiplatelet Therapy
- Statin
- Beta-blocker
- ACE/ARB Antagonist
Medical Therapy to Improve Prognosis

- Aspirin reduces CV events by 35%
- 81 mg dose offers similar antithrombotic effect as 325 mg dose with reduced risk of bleeding
- Clopidogrel recommended if intolerant to ASA.
- May have modest benefit in reducing events compared to ASA (CAPRIE trial)
Medical Therapy to Improve Prognosis

- Reduce CV events ~25% for every 40 mg/dL decrease in LDL
- High Intensity Statin to recommended to Lower LDL > 50% in most patients
  - Crestor 20-40mg
  - Lipitor 40-80mg
- Consider ezetimibe or PCSK9 inhibitor in patients who do not attain an LDL < 70 and at high risk of events.
Medical Therapy to Improve Prognosis

- Antiplatelet Therapy
- Statin
- Beta-blocker
- ACE/ARB Antagonist

- Reduce death/MI after a coronary event
- Should be continued for at least 3 years
- Unless contraindicated, use for:
  - Prior MI
  - LV systolic dysfunction (EF < 40%)
Medical Therapy to Improve Prognosis

- Greatest benefit in:
  - History of MI
  - LVEF < 40%

- Reduced cardiac events also seen in:
  - HTN
  - DM
  - CKD
  - Other vascular disease
90% of the risk of MI is attributable to 9 key risk factors

1. Smoking
2. Diabetes
3. Hypertension
4. Dyslipidemia
5. Obesity
6. Poor Diet
7. Lack of exercise
8. Alcohol consumption
9. Impaired psychological well-being
Lifestyle Modifications

1. Lipid Management
   - High Intensity Statin to Lower LDL > 50%
Lifestyle Modifications

1. Lipid Management
2. Blood Pressure Management
   - Goal BP < 130/80 mmHg for SIHD*

*updated from < 140/90 per new HTN guidelines
Lifestyle Modifications

1. Lipid Management
2. Blood Pressure Management
3. Diabetes Management
   – Goal HgA1c < 7% suggested for most
Lifestyle Modifications

1. Lipid Management
2. Blood Pressure Management
3. Diabetes Management
4. Physical Activity
   - 30-60 minutes of moderate-intensity aerobic activity (e.g. brisk walking) at least 5 days/week
Lifestyle Modifications

1. Lipid Management
2. Blood Pressure Management
3. Diabetes Management
4. Physical Activity
5. Weight Management
   - Goal BMI < 25 kg/m²
Lifestyle Modifications

1. Lipid Management
2. Blood Pressure Management
3. Diabetes Management
4. Physical Activity
5. Weight Management
6. Smoking Cessation
   - Encourage cessation frequently
   - Referral to cessation programs
   - Pharmacotherapy (nicotine replacement therapy, bupropion, varenicline)
Medical Therapy to Improve Symptoms
Anti-Anginal Therapy
“Quality of Life”

- Beta-Blockers
- Calcium Channel Blockers
- Nitrates
- Ranolozine
# Anti-Anginal Therapy

<table>
<thead>
<tr>
<th>Drug</th>
<th>Mechanism</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta Blockers</td>
<td>• Reduce HR</td>
<td>• <strong>Symptoms:</strong> Fatigue, Lethargy</td>
</tr>
<tr>
<td></td>
<td>• Reduce Contractility</td>
<td>• <strong>Conditions:</strong> AV block, Reactive airway disease</td>
</tr>
<tr>
<td></td>
<td>• Reduce Afterload</td>
<td></td>
</tr>
<tr>
<td>Calcium Channel Blockers</td>
<td>• Reduce afterload</td>
<td>• <strong>Symptoms:</strong> Hypotension, Edema, Constipation</td>
</tr>
<tr>
<td></td>
<td>• Increase coronary flow</td>
<td>• <strong>Conditions:</strong> AV block, Systolic Heart Failure</td>
</tr>
<tr>
<td></td>
<td>• +/- Reduce HR and contractility</td>
<td></td>
</tr>
<tr>
<td>Nitrates</td>
<td>• Decrease Preload</td>
<td>• <strong>Symptoms:</strong> Headache, Flushing, Hypotension</td>
</tr>
<tr>
<td></td>
<td>• Increase coronary flow</td>
<td>• <strong>Conditions:</strong> Severe AS, HCM, Phosphodiesterase inhibitors</td>
</tr>
<tr>
<td>Ranolozine</td>
<td>• Inhibits Na channel</td>
<td>• <strong>Symptoms:</strong> Nausea, Constipation, Dizziness</td>
</tr>
<tr>
<td></td>
<td>• Prevents calcium overload</td>
<td>• <strong>Conditions:</strong> QT prolongation, Advanced liver disease</td>
</tr>
<tr>
<td></td>
<td>• Reduces diastolic tension</td>
<td></td>
</tr>
</tbody>
</table>
Anti-Anginal Therapy

• Effective at reducing # of angina episodes and amount of nitroglycerin use

• Effective at improving exercise time

• But no single class has demonstrated superiority over another
Where does Revascularization fit in?
Stable Ischemic Heart Disease

Guideline-Directed Medical Therapy with ongoing patient education

Anginal Symptoms?

- Yes
  - Sublingual NTG
  - Beta blocker if no contraindication (Espec. if prior MI, heart failure, or other indication)
    - Yes
      - Successful Treatment?
        - Yes
        - No
    - No
      - Serious Contraindication
        - Add/substitute CCB and/or long-acting nitrates if no contraindication
          - Yes
            - Successful Treatment?
              - Yes
              - No
          - No
            - Serious Contraindication
              - Add/substitute ranolazine
                - Yes
                  - Successful Treatment?
                    - Yes
                    - No
                - No
                  - Persistent symptoms despite adequate trial of Guideline-Directed Medical Therapy
                    - Yes
                      - Consider revascularization to improve symptoms
                        - Go to Figure 5
                    - No

- No
Diagnosing and Treating SEVERE CAD is Prognostically Important!
## CAD Prognostic Index

<table>
<thead>
<tr>
<th>Extent of CAD</th>
<th>Prognostic Weight (0–100)</th>
<th>5-Year Survival Rate (%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-vessel disease, 75%</td>
<td>23</td>
<td>93</td>
</tr>
<tr>
<td>1-vessel disease, 50% to 74%</td>
<td>23</td>
<td>93</td>
</tr>
<tr>
<td>1-vessel disease, ≥95%</td>
<td>32</td>
<td>91</td>
</tr>
<tr>
<td>2-vessel disease</td>
<td>37</td>
<td>88</td>
</tr>
<tr>
<td>2-vessel disease, both ≥95%</td>
<td>42</td>
<td>86</td>
</tr>
<tr>
<td>1-vessel disease, ≥95% proximal LAD artery</td>
<td>48</td>
<td>83</td>
</tr>
<tr>
<td>2-vessel disease, ≥95% LAD artery</td>
<td>48</td>
<td>83</td>
</tr>
<tr>
<td>2-vessel disease, ≥95% proximal LAD artery</td>
<td>56</td>
<td>79</td>
</tr>
<tr>
<td>3-vessel disease</td>
<td>56</td>
<td>79</td>
</tr>
<tr>
<td>3-vessel disease, ≥95% in ≥1 vessel</td>
<td>63</td>
<td>73</td>
</tr>
<tr>
<td>3-vessel disease, 75% proximal LAD artery</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>3-vessel disease, ≥95% proximal LAD artery</td>
<td>74</td>
<td>59</td>
</tr>
</tbody>
</table>
# Anti-Anginal Therapy

## An Alternative Perspective

### Mechanisms

<table>
<thead>
<tr>
<th>Drug</th>
<th>Benefit post-MI or Reduced EF</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta Blockers</td>
<td>• Reduce HR&lt;br&gt;• Reduce Contractility&lt;br&gt;• Reduce afterload</td>
<td>• Symptomatic&lt;br&gt;• Conditions: AV block, Reactive airway disease</td>
</tr>
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<td>• Reduce afterload&lt;br&gt;• Increase coronary flow</td>
<td>• Symptomatic&lt;br&gt;• Conditions: AV block, Systolic Heart Failure</td>
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<td>Nitrates</td>
<td>• Decrease Preload&lt;br&gt;• Increase coronary flow</td>
<td>• Symptomatic&lt;br&gt;• Conditions: Severe AS, HCM, Phosphodiesterase inhibitors</td>
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<tr>
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<td>• Inhibits Na channel&lt;br&gt;• Prevents calcium overload&lt;br&gt;• Reduces diastolic tension</td>
<td>• Symptomatic&lt;br&gt;• Conditions: QT prolongation, Advanced liver disease</td>
</tr>
</tbody>
</table>

### Hard Outcomes

- Benefit post-MI or Reduced EF
- No Benefit
- No Benefit
- No Benefit

### Non-Adherence

- Polypharmacy
- Side-Effects
- Cost

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**Legend:**
- **Beta Blockers:** Reduce HR, Reduce Contractility, Reduce afterload.
- **Calcium Channel Blockers:** Reduce afterload, Increase coronary flow.
- **Nitrates:** Decrease Preload, Increase coronary flow.
- **Ranolozine:** Inhibits Na channel, Prevents calcium overload, Reduces diastolic tension.
2 Primary Goals for Revascularization of SIHD

Prevent Death and MI (Disease Modification)

→ Improve “Quantity of Life”

Reduce Angina and Relieve Ischemia

→ Improve “Quality of Life”
CABG Improves Survival

Yusuf et al. Lancet 1994
Revascularization

CABG vs. Stents?
SYNTAX Trial Design

- Largest randomized trial comparing CABG vs. PCI
- Included patients with LMCA (40%) and 3-vessel CAD (60%)
- 1800 patients randomized 1:1
- Endpoint: Death, MI, CVA, Repeat Revascularization

Heart Team (surgeon & interventional cardiologist)

- Amenable for both treatment options
- Stratified: LM and D

Randomized Arms
N=1800

- CABG: n=897
  - 3VD: n=549 (66.3%)
  - LM: n=348 (33.7%)

- TAXUS*: n=903
  - 3VD: n=546 (65.4%)
  - LM: n=357 (34.6%)

*TAXUS Express
Repeat Revascularization to 5 Years

CABG (N=897)  TAXUS (N=903)

<table>
<thead>
<tr>
<th>Duration</th>
<th>CABG Rate</th>
<th>TAXUS Rate</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1 year</td>
<td>5.9%</td>
<td>13.5%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>1–2 years</td>
<td>3.7%</td>
<td>5.6%</td>
<td>0.06</td>
</tr>
<tr>
<td>2–3 years</td>
<td>2.5%</td>
<td>3.4%</td>
<td>0.33</td>
</tr>
<tr>
<td>3–4 years</td>
<td>1.6%</td>
<td>4.2%</td>
<td>&lt;0.002</td>
</tr>
<tr>
<td>4–5 years</td>
<td>1.9%</td>
<td>4.3%</td>
<td>&lt;0.008</td>
</tr>
</tbody>
</table>

P<0.001

Cumulative Event Rate (%) 50 50

Cumulative KM Event Rate ± 1.5 SE; log-rank P value; *Binary rates

ITT population
Myocardial Infarction to 5 Years

- **CABG (N=897)**
  - Before 1 year*: 3.3% vs 4.8%; *P=0.11
  - 1–2 years*: 0.1% vs 1.2%; *P=0.008
  - 2–3 years*: 0.3% vs 1.2%; *P=0.03
  - 3–4 years*: 0.3% vs 1.5%; *P=0.01
  - 4–5 years*: 0% vs 1.2%; *P=0.004

- **TAXUS (N=903)**

Cumulative Event Rate (%)

$P<0.001$

Cumulative KM Event Rate ± 1.5 SE; log-rank $P$ value; *Binary rates

ITT population
All-Cause Death to 5 Years

CABG (N=897)  TAXUS (N=903)

Before 1 year* 3.5% vs 4.4%  P=0.37
1–2 years* 1.5% vs 1.9%  P=0.53
2–3 years* 1.9% vs 2.6%  P=0.32
3–4 years* 2.2% vs 3.2%  P=0.22
4–5 years* 3.1% vs 2.3%  P=0.34

P=0.10

Cumulative Event Rate (%)

Months Since Allocation

Cumulative KM Event Rate ± 1.5 SE; log-rank P value; *Binary rates

ITT population
CVA to 5 Years

- CABG (N=897)
  - Before 1 year: 2.2% vs 0.6%, *P=0.003
  - 1–2 years: 0.6% vs 0.7%, *P=0.82
  - 2–3 years: 0.5% vs 0.6%, *P=1.00
  - 3–4 years: 0.4% vs 0.2%, *P=0.68
  - 3–4 years: 0% vs 0.1%, *P=1.00

- TAXUS (N=903)

Cumulative Event Rate (%)

*Cumulative KM Event Rate ± 1.5 SE; log-rank *P* value; *Binary rates*

ITT population
“SYNTAX Score”

3. Specify which segments are diseased for lesion 1. Click on the coronary tree image to select or unselect segments.

<table>
<thead>
<tr>
<th>Segments:</th>
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<th></th>
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<tbody>
<tr>
<td>RCA</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>RCA proximal</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RCA mid</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RCA distal</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posterior descending</td>
<td>4</td>
<td></td>
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</tr>
<tr>
<td>Posterolateral from RCA</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posterolateral from RCA</td>
<td>16a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posterolateral from RCA</td>
<td>16b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posterolateral from RCA</td>
<td>16c</td>
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<td></td>
</tr>
<tr>
<td>LM (Left main)</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAD</td>
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</tr>
<tr>
<td>LAD proximal</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAD mid</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAD apical</td>
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</tr>
<tr>
<td>First diagonal</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Add. first diagonal</td>
<td>9a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second diagonal</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Add. second diagonal</td>
<td>10a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCX</td>
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</tr>
<tr>
<td>Proximal circumflex</td>
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<td></td>
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</tr>
<tr>
<td>Intermediate/antrolateral</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obtuse marginal</td>
<td>12a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obtuse marginal</td>
<td>12b</td>
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<tr>
<td>Distal circumflex</td>
<td>13</td>
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<tr>
<td>Left posterolateral</td>
<td>14</td>
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<tr>
<td>Left posterolateral</td>
<td>14a</td>
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<td></td>
</tr>
<tr>
<td>Left posterolateral</td>
<td>14b</td>
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<table>
<thead>
<tr>
<th>SYNTAX Score</th>
<th>≤22</th>
<th>23-32</th>
<th>≥33</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Intermediate</td>
<td>High</td>
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</table>
SYNTAX Trial Outcomes
Stratified by SYNTAX Score

Figure 3. MACCE Through 4 years by SYNTAX Score (Overall Cohort).

- Low SYNTAX Scores (0–22)
  - P=0.57
  - CABG: 28.6%
  - TAXUS: 26.1%

- Intermediate SYNTAX Scores (23–32)
  - P=0.006
  - CABG: 32.0%
  - TAXUS: 31.0%

- High SYNTAX Scores (33+)
  - P<0.001
  - CABG: 40.1%
  - TAXUS: 33.6%

<table>
<thead>
<tr>
<th>Low Scores</th>
<th>CABG</th>
<th>PCI</th>
<th>P value</th>
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</thead>
<tbody>
<tr>
<td>Death</td>
<td>8.9%</td>
<td>8.3%</td>
<td>0.77</td>
</tr>
<tr>
<td>CVA</td>
<td>4.0%</td>
<td>1.4%</td>
<td>0.059</td>
</tr>
<tr>
<td>MI</td>
<td>4.2%</td>
<td>6.6%</td>
<td>0.25</td>
</tr>
<tr>
<td>Death, CVA or MI</td>
<td>14.6%</td>
<td>14.4%</td>
<td>0.87</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intermediate Scores</th>
<th>CABG</th>
<th>PCI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>9.3%</td>
<td>11.1%</td>
<td>0.49</td>
</tr>
<tr>
<td>CVA</td>
<td>3.6%</td>
<td>2.0%</td>
<td>0.25</td>
</tr>
<tr>
<td>MI</td>
<td>3.6%</td>
<td>9.0%</td>
<td>0.009</td>
</tr>
<tr>
<td>Death, CVA or MI</td>
<td>14.9%</td>
<td>17.3%</td>
<td>0.44</td>
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</table>

<table>
<thead>
<tr>
<th>High Scores</th>
<th>CABG</th>
<th>PCI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>8.4%</td>
<td>16.1%</td>
<td>0.004</td>
</tr>
<tr>
<td>CVA</td>
<td>3.7%</td>
<td>3.5%</td>
<td>0.8</td>
</tr>
<tr>
<td>MI</td>
<td>3.9%</td>
<td>9.3%</td>
<td>0.01</td>
</tr>
<tr>
<td>Death, CVA or MI</td>
<td>14.6%</td>
<td>22.7%</td>
<td>0.01</td>
</tr>
<tr>
<td>Revasc.</td>
<td>11.4%</td>
<td>28.8%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Figure 3. Examples of SYNTAX scores
FREEDOM Trial
1900 Patients with Diabetes
Randomized 1:1 to MV-PCI vs. CABG
Primary Endpoint: Death / MI / Stroke
FREEDOM Trial

Individual Outcomes: ↓ Death, MI, Revasc; ↑ Stroke
1,212 Patients with CAD and reduced EF randomized to OMT vs. OMT/CABG

Baseline EF 28%

75% Multi-vessel CAD; 68% Prox LAD 68%

10-year follow up
Mortality Benefit

CABG

- LMCA
- 3v CAD
- 2v CAD (prox LAD)

PCI

- LMCA (low SYNTAX)

- LMCA (Int SYNTAX)
- 3v CAD
- 2v CAD (prox LAD)
- 2v CAD (no prox LAD)
- 1v prox LAD

- 1v non prox LAD
When Evidence Says No, But Doctors Say Yes

Years after research contradicts common practices, patients continue to demand them and doctors continue to deliver. The result is an epidemic of unnecessary and unhelpful treatment.

by David Epstein, ProPublica
February 22, 2017

This story was co-published with The Atlantic.

Stents for stable patients prevent zero heart attacks and extend the lives of patients a grand total of not at all.
COURAGE Trial: PCI in SIHD

Median follow-up 4.6 years (n=2,287)

Optimal Medical Therapy (OMT)

PCI + OMT

Hazard ratio: 1.05
95% CI (0.87-1.27)
P = 0.62

33% PCI rate in OMT; 21% repeat PCI in PCI group

Boden WE et al. NEJM 2007;356:1503-16
COURAGE Trial: Enrollment

35,539 Patients assessed

32,468 patients were excluded
- 8,677 Did not meet inclusion criteria
- 5,155 Had undocumented ischemia
- 3,961 Did not meet protocol for vessels
- 6,554 Were excluded for logistic reasons
- 18,360 Had one or more exclusions
  - 4,513 Had undergone recent (<6 mo) revascularization
  - 4,939 Had an inadequate ejection fraction
  - 2,987 Had a contraindication to PCI
  - 2,542 Had a serious coexisting illness
  - 1,285 Had concomitant valvular disease
  - 1,203 Had class IV angina
  - 1,071 Had a failure of medical therapy
    - 947 Had left main stenosis >50%
    - 722 Had only PCI restenosis (no new lesions)
    - 528 Had complications after MI

3,071 (8.6%) met eligibility criteria
PCI vs. Medical Therapy: SIHD
12 RCTs, 7182 Patients

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Favors PCI</th>
<th>Favors MT</th>
<th>RR</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-cause mortality</td>
<td></td>
<td></td>
<td>0.85 [0.71, 1.01]</td>
<td>0.07</td>
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<tr>
<td>Cardiac death</td>
<td></td>
<td></td>
<td>0.71 [0.47, 1.06]</td>
<td>0.09</td>
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<tr>
<td>Nonfatal MI</td>
<td></td>
<td></td>
<td>0.93 [0.70, 1.24]</td>
<td>0.61</td>
</tr>
<tr>
<td>Repeat Revascularization</td>
<td></td>
<td></td>
<td>0.93 [0.76, 1.14]</td>
<td>0.47</td>
</tr>
<tr>
<td>Angina</td>
<td></td>
<td></td>
<td>0.83 [0.73, 0.94]</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Pursnani et al, Circ CV Intv 2012
COURAGE Trial

More ischemia associated with higher mortality

Boden WE et al. NEJM 2007;356:1503-16
COURAGE Trial
Reduction in ischemia associated with improved mortality

RR=0.47 (95% CI=0.23-0.95)

\( p=0.037 \)

24.7%

13.4%

Death or MI Rate (%)

Ischemia Reduction ≥5% (n=82)

No Ischemia Reduction (n=232)

Boden WE et al. NEJM 2007;356:1503-16
Observational Study: Revascularization associated with lower risk of cardiac death if >10% ischemia on MPI
ISCHEMIA Trial Design

Ischemia- Eligible Stable Patient (Stable CAD, Moderate-Severe Ischemia)

Blinded Coronary CTA

Eligible Anatomy?

YES
RANDOMIZE
Invasive Strategy (Cath with Optimal Revasc + OMT)

NO
CT Exclusion Ancillary Study

OMT Strategy (OMT Alone)
What to expect from the ISCHEMIA Trial?

- Determine whether an invasive strategy reduces the risk of Death/MI in patients with moderate-to-severe ischemia

- Will incorporate more modern techniques and technology into revascularization
  - Heart Team approach
  - Contemporary current generation DES

- Will have a separate arm enrolling CKD patients, largely neglected from RCTs
What Has Changed Since COURAGE, SYNTAX, and FREEDOM?

• Better Stents
  • Less restenosis
  • Less stent thrombosis

• Better Pharmacotherapy
  • More consistent anti-platelet effect
  • Lower rate of clinical events in ACS patients

• More judicious use of PCI for by incorporating invasive physiology (FFR) to treat only lesions that are ischemia-producing

• PCI optimization (Intravascular imaging)

• Patient-centered approach to case selection
Important Concept:

Patient preferences matter
Closing Thoughts

• SIHD remains the most common cause or morbidity/mortality in the world despite advances.

• Diagnosis centers on appropriate clinical suspicion supported by noninvasive testing and/or referral for evaluation.

• Management of SIHD involve the dual goals of improving prognosis and improving symptoms.
Closing Thoughts

• These goals are achievable with a combination of lifestyle modifications, medications, and in select patients, revascularization.

• In order for revascularization to provide benefit, it must be performed on lesions that are actually causing symptoms or a reduction in quality of life.

• The optimal revascularization strategy is dependent on many factors including patient characteristics (age, DM, frailty), presence/degree of ischemia, coronary anatomy, and should include consideration of patient preferences. Both PCI and CABG can have very good outcomes in appropriately selected patients.
Thank You