Surgical Perspectives on Myocardial Revascularization

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Surgical Perspectives

• Syntax Trial

• The Heart Team

• The Power of the LIMA

• Future Considerations
SYNTAX

Heart Team (surgeon & interventionalist)

Amenable for both treatment options
Amenable for only one treatment approach

Stratification: LM and 3V CAD

Randomized Arms
N=1800

CABG N=897
TAXUS* N=903

3VD 66.3%
LM 33.7%
3VD 65.4%
LM 34.6%

Two Registry Arms
N=1275

CABG N=1077
PCI N=198

62 EU Sites + 23 US Sites

66.3% enrolled (N=3,075)

All Pts with de novo 3VD and/or LM disease (N=4,337)

Treatment preference (9.4%)
Referring MD or pts. refused informed consent (7.0%)
Inclusion/exclusion (4.7%)
Withdrew before consent (4.3%)
Other (1.8%)
Medical treatment (1.2%)

TAXUS n=903
PCI n=198
CABG n=1077

CABG n=897

no f/u
5yr f/u

2500
750 w/ f/u

Amenable for only one treatment approach
Amenable for both treatment options

Stratification:
LM and 3V CAD

SYNTAX

*TAXUS Express
Patient Profiling

Heart Team (surgeon & interventional cardiologist) assessed each patient

- Patient’s operative risk
- Coronary lesion complexity
- Goal:
  - SYNTAX score to provide guidance on optimal revascularization strategies for patients with high risk lesions

Valgimigli et al, Am J Cardiol 2007;99:1072–1081

BARI classification of coronary segments
Leaman score, Circ 1981;63:285-299
Lesions classification ACC/AHA, Circ 2001;103:3019-3041
Bifurcation classification, CCI 2000;49:274-283
CTO classification, J Am Coll Cardiol 1997;30:649-656
There is ‘3-vessel disease’ and ‘3-vessel disease’
MACCE to 5 Years by SYNTAX Score Tercile *Low Scores (0–22)*

- CABG (N=275)
- TAXUS (N=299)

**Overall**

<table>
<thead>
<tr>
<th></th>
<th>CABG</th>
<th>PCI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>10.1%</td>
<td>8.9%</td>
<td>0.64</td>
</tr>
<tr>
<td>CVA</td>
<td>4.0%</td>
<td>1.8%</td>
<td>0.11</td>
</tr>
<tr>
<td>MI</td>
<td>4.2%</td>
<td>7.8%</td>
<td>0.11</td>
</tr>
<tr>
<td>Death, CVA or MI</td>
<td>14.9%</td>
<td>16.1%</td>
<td>0.81</td>
</tr>
<tr>
<td>Revasc.</td>
<td>16.9%</td>
<td>23.0%</td>
<td>0.06</td>
</tr>
</tbody>
</table>

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

Core lab–reported Data; ITT population
MACCE to 5 Years by SYNTAX Score Tercile *High Scores (≥33)*

<table>
<thead>
<tr>
<th></th>
<th>CABG</th>
<th>PCI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>11.4%</td>
<td>19.2%</td>
<td>0.005</td>
</tr>
<tr>
<td>CVA</td>
<td>3.7%</td>
<td>3.5%</td>
<td>0.80</td>
</tr>
<tr>
<td>MI</td>
<td>3.9%</td>
<td>10.1%</td>
<td>0.004</td>
</tr>
<tr>
<td>Death, CVA or MI</td>
<td>17.1%</td>
<td>26.1%</td>
<td>0.007</td>
</tr>
<tr>
<td>Revasc.</td>
<td>12.1%</td>
<td>30.9%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Cumulative KM Event Rate ± 1.5 SE; log–rank P-value

Core lab–reported Data; ITT population

SYNTAX 5-year Outcomes • ESC 2012 • Mohr • August 2017 • Slide 16
SYNTAX Results

• Favor CABG in more complex CAD
  – High Syntax Scores
  – 79% of 3 vessel CAD best treated with CABG
• PCI and CABG in less complex CAD
  – Lower Syntax scores
• PCI risk increases with Syntax Score
  – CABG risk does not
• The Heart Team Approach
CABG compared to PCI

- PCI is endovascular. Longer segment disease = longer stent and increased restenosis / thrombosis risk

- CABG can bypass longer segments of disease

- Extent of disease determines best approach.

Gersh and Frye NEJM, May 2005
SYNTAX: The Heart Team

• Cardiac Surgeon and Interventional Cardiologist collaborate on treatment
• Formal review of anatomic features of disease
• Risk Assessment
• Communication to Care Team
• Heart Teams already in use in TAVR and Heart Failure
Heart Team Goals

• Provides a multi-disciplinary balanced approached
• Shared stakeholders participate in shared decision making
• Framework for cognitive interchange that helps reduce individual treatment bias
• Patients and Families exposed to broader treatment options
Heart Team Benefits

• Better / Shared Decision Making
  – Avoids fragmented decisions
• Improved communication within the Health Care System
• Improves timeliness of care and efficiency
• Increases “shared learning” and collaboration between specialists
• Research and Clinical Trials
Barriers to Heart Teams

• Engaging and Coordinating consultations between busy specialists
• Ensuring adequate input from Team members
• Resolution of Differences in opinion
• Communicate recommendations to Health System and Families
• Ensuring equitable reimbursement across specialties
• What Cases Benefit? Which Specialties?
A Heart Team approach to revascularization is recommended in patients with unprotected left main or complex CAD.

Calculation of the STS and SYNTAX scores is reasonable in patients with unprotected left main and complex CAD.

2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease
CABG: LIMA Use

- Improves early (<30day) CABG survival
- Improves late CABG outcomes
- Use recommended by ACC/AHA guidelines
- The only intraoperative STS quality metric
INFLUENCE OF THE INTERNAL-MAMMARY-ARTERY GRAFT ON 10-YEAR SURVIVAL AND OTHER CARDIAC EVENTS

FLOYD D. LOOP, M.D., BRUCE W. LYTLLE, M.D., DELOS M. COSGROVE, M.D., ROBERT W. STEWART, M.D., MARLENE GOORMATIC, M.P.H., GEORGE W. WILLIAMS, PH.D., LEONARD A.R. GOLING, M.D., CARL C. GILL, M.D., PAUL C. TAYLOR, M.D., WILLIAM C. SHELDON, M.D., AND WILLIAM L. PROUDFIT, M.D.

Abstract  We compared patients who received an internal-mammary-artery graft to the anterior descending coronary artery alone or combined with one or more saphe nous-vein grafts (n = 2306) with patients who had only saphenous-vein bypass grafts (n = 3625). The 10-year actuarial survival rate among the group receiving the internal-mammary-artery graft, as compared with the group who received the vein grafts (exclusive of hospital deaths), was 93.4 percent versus 88.0 percent (P = 0.05) for those with one-vessel disease; 90.0 percent versus 79.5 percent (P <0.0001) for those with two-vessel disease; and 82.6 percent versus 71.0 percent (P <0.0001) for those with three-vessel disease. After an adjustment for demographic and clinical differences by Cox multivariate analysis, we found that patients who had only vein grafts had a 1.61 times greater risk of death throughout the 10 years, as compared with those who received an internal-mammary-artery graft. In addition, patients who received only vein grafts had 1.41 times the risk of late myocardial infarction (P <0.0001), 1.25 times the risk of hospitalization for cardiac events (P <0.0001), 2.00 times the risk of cardiac reoperation (P <0.0001), and 1.27 times the risk of all late cardiac events (P <0.0001), as compared with patients who received internal-mammary-artery grafts. Internal-mammary-artery grafting for lesions of the anterior descending coronary artery is preferable whenever indicated and technically feasible. (N Engl J Med 1986; 314:1-6.)
IMA: Survival Benefit

Loop / Cleveland Clinic
5,931 patients 1971 - 1979

Compared 10 year survival and other events
  MI
  Reoperation

IMA to LAD  2306 patients
SVG's     3625 patients

Loop  NEJM  1986
Figure 3. Ten-Year Survival of Patients with Three-Vessel Disease

The internal-mammary-artery group contained those who had one internal-mammary-artery graft and one or more saphenous-vein grafts. The saphenous-vein-graft group had vein grafts only. The differences between the two groups were significant by both univariate and multivariate analysis.
## Operative Mortality and Risk
**IMA Use: STS Data 1987 - 1991**

<table>
<thead>
<tr>
<th>Predicted Risk Group</th>
<th>IMA USE</th>
<th>IMA Mortality</th>
<th>No IMA Mortality</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1.14%</td>
<td>54%</td>
<td>0.7%</td>
<td>0.9%</td>
<td>&lt;0.250</td>
</tr>
<tr>
<td>1.14 - 2.17%</td>
<td>53%</td>
<td>1.3%</td>
<td>2.3%</td>
<td>&lt;0.005*</td>
</tr>
<tr>
<td>2.17 - 4.52%</td>
<td>48%</td>
<td>2.0%</td>
<td>3.9%</td>
<td>&lt;0.005*</td>
</tr>
<tr>
<td>4.52 - 100%</td>
<td>37%</td>
<td>4.8%</td>
<td>9.1%</td>
<td>&lt;0.005*</td>
</tr>
</tbody>
</table>
IMA: Improved Operative Mortality and Long Term Survival

• Why?
  – Better long term patency
  – Better short term patency
  – LAD territory

• Early Vein Graft Failure
  – How significant is this role?
Clinical Events in patients with Vein Graft Failure

Table 5. Clinical Event in Patients by Vein Graft Failure Status

<table>
<thead>
<tr>
<th>Type of Event</th>
<th>No./Total (%) of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vein Graft Failure (n = 878)</td>
</tr>
<tr>
<td>Perioperative MI in CABG surgery</td>
<td>118 (13.4)</td>
</tr>
<tr>
<td>Death or MI*</td>
<td>122 (13.9)</td>
</tr>
<tr>
<td>Death, MI,* or revascularization</td>
<td>228 (26.0)</td>
</tr>
</tbody>
</table>

Abbreviations: CABG, coronary artery bypass graft; MI, myocardial infarction.
*Not including perioperative MI in CABG surgery.

Clinical events were significantly greater in patients that had early vein graft failure

Efficacy and Safety of Edifoligide, an E2F Transcription Factor Decoy, for Prevention of Vein Graft Failure Following Coronary Artery Bypass Graft Surgery
PREVENT IV: A Randomized Controlled Trial
CABG: IMA Utilization

- IMA use during CABG has steadily increased in the STS database

- Low IMA utilization found
  - High risk cases
  - Specific programs
IMA Use
STS Predicted Mortality Risk

STS National Database
Use of a Statewide Cardiac Surgery Quality Collaborative for Process Improvement: Internal Mammary Artery Utilization During Coronary Artery Bypass Grafting

Scott H. Johnson, MD, Patricia F. Theurer, BSN,* Gail F. Bell, MSN,* Luigi Maresca MD, Thomas Leyden, BA, and Richard L. Prager, MD for the Michigan Society of Thoracic and Cardiovascular Surgeons

56th Annual Southern Thoracic Surgical Association
Marco Island, Florida 2009
IMA Use in Isolated CABG
Michigan 2005

Michigan Cardiac Surgery Programs

STS Mean
Michigan 90% Benchmark
Low IMA Users

Michigan Cardiac Surgery Programs
IMA Use in Isolated CABG
STS, Michigan and Low IMA Users

P < 0.0001
Improve Constantly

• 10-14% of 3 vessel CAD patients dead at 5 years
  – Why?
    • Graft failure / stent thrombosis
    • Progression of disease
    • Risk Factors

• Opportunities for Improvement
  – Transitional care
  – Reducing complications
Conclusions

• Heart Team approach for Complex CV Disease
  – CAD
  – Valve disease
  – Heart Failure
• Collaborative Care
  – Break down barriers
  – Share information
• Increase Arterial Grafting
• Hybrid Revascularization