Optimal Conduit Strategy in 2017

David P Taggart MD PhD FRCS
Professor of Cardiovascular Surgery, University of Oxford

Conflicts of Interest: None Relevant
(i) Clinical: Cardiac Surgeon and OPCABG surgeon (95%)
(ii) Academic: ESC/EACTS Guideline Writer, PI of Several CABG trials
(iii) Commercial: Advisor to VGS, Medistim, Medtronic, Somahlution, Cardioguard, Stryker, Neograft

SAHA 2017
Saphenous Vein Autograft Replacement of Severe Segmental Coronary Artery Occlusion

Operative Technique

Rene G. Favaloro, M.D.

First SYSTEMATIC report of SV grafts for CABG
Percutaneous Coronary Intervention versus Coronary-Artery Bypass Grafting for Severe Coronary Artery Disease

Patrick W. Serruys, M.D., Ph.D., Marie-Claude Morice, M.D., A. Pieter Kappetein, M.D., Ph.D., Antonio Colombo, M.D., David R. Holmes, M.D., Michael J. Mack, M.D., Elisabeth Stähle, M.D., Ted E. Feldman, M.D., Marcel van den Brand, M.D., Eric J. Bass, B.A., Nic Van Dyck, R.N., Katrin Leadley, M.D., Keith D. Dawkins, M.D., and Friedrich W. Mohr, M.D., Ph.D., for the SYNTAX Investigators*

Strategies for Multivessel Revascularization in Patients with Diabetes


Everolimus-Eluting Stents or Bypass Surgery for Left Main Coronary Artery Disease


Percutaneous coronary angioplasty versus coronary artery bypass grafting in treatment of unprotected left main stenosis (NOBLE): a prospective, randomised, open-label, non-inferiority trial

Timo Makikallio, Niels R Holm, Mitchell Lindsay, Mark S Spence, Andrejs Erglis, Ian B A Menown, Thor Trivik, Markku Eskola, Hannu Romppanen, Thomas Kellerth, Jan Rovikilde, Lisette O Jensen, Gintaras Kalinauskas, Rikard B A Linder, Markku Penttikainen, Anders Hervold, Adrian Banning, Arefz Zaman, Janne Cotton, Erlend Enknik, Sulev Margus, Henrik T Sarenensen, Per H Nielsen, Matti Niemela, Kari Kervinen, Jens F Lassen, Michael Maeng, Keith Oldroyd, Geoff Berg, Simon J Walsh, Colm G Hanratty, Indulis Kumsars, Peteris Stradins, Terje K Steigen, Ole Frobøe, Alastair N Graham, Petter C Endresen, Matthias Cerbeschius, Olli Kajander, Uday Trivedi, Juha Hartikainen, Vesa Anttila, David Hildick-Smith, Leif Thuesen, Ewald H Christiansen, for the NOBLE study investigators*
While some contemporary studies show much superior vein graft patency, the largest angiographic study (PREVENT IV) shows similar patency.
### Contemporary 5-year Angiographic Patency: All RCT of SVG vs RA

**IMA, Saphenous Vein and Radial Artery @ 5 Years**

<table>
<thead>
<tr>
<th></th>
<th>Radial artery (N=669)</th>
<th>Saphenous vein (N=636)</th>
<th>Total (N=1305)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to angiography</td>
<td>5.0 (3.3-7.1)</td>
<td>5.2 (3.0-7.5)</td>
<td>5.1 (3.1-7.3)</td>
<td>0.369</td>
</tr>
<tr>
<td>Angiography</td>
<td>482 (72.1%)</td>
<td>441 (69.3%)</td>
<td>923 (70.7%)</td>
<td>0.282</td>
</tr>
<tr>
<td>Study conduit patency</td>
<td>535 (91.2%)</td>
<td>426 (79.3%)</td>
<td>961 (85.8%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Additional graft patency</td>
<td>38 (92.7%)</td>
<td>38 (88.4%)</td>
<td>76 (90.5%)</td>
<td>0.509</td>
</tr>
<tr>
<td>LIMA patency</td>
<td>359 (95.7%)</td>
<td>362 (94.8%)</td>
<td>721 (95.2%)</td>
<td>0.532</td>
</tr>
</tbody>
</table>

*Do not distinguish between stenotic artery and CTO*

*Historical studies: 25% of SVG occluded at 5 years*
1986: SURVIVAL BENEFIT OF AN ITA GRAFT

The New England Journal of Medicine

Volume 314
JANUARY 2, 1986

INFLUENCE OF THE INTERNAL-MAMMARY-ARTERY-TO-LAD-GRAFT ON CLINICAL AND OTHER CARDIAC ENDPOINTS

Floyd D. Loop, M.D., Bruce W. Lytle, M.D., Donald W. Stewart, M.D., Marlene Goormastic, M.P.H., George E. Green, M.D., Paul A. Golding, M.D., Carl C. Gill, M.D., Paul A. Brogno, M.D., and John Thornton, PhD

O 10 years after CABG, an IMA to the LAD ↓ risk of:
  • death (x1.6), MI (x1.4), angina (x1.25), redo surgery (x2)
  • Patency rate of > 95% at 10 years (veins = 25% - 50%)

IF IT WAS NOT FOR THE ITA THERE WOULD BE NO CABG TODAY !!!!
## ANGIOGRAPHIC PATENCY OF BILATERAL ITA

<table>
<thead>
<tr>
<th>STUDY</th>
<th>NOS (%)</th>
<th>TIME</th>
<th>LIMA</th>
<th>RIMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wendler (CIRC 2000)</td>
<td>172 (35%)</td>
<td>7 days</td>
<td>98</td>
<td>97</td>
</tr>
<tr>
<td>Endo (CIRC 2002)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1100 (98%)</td>
<td>7 days</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>Calafiore (JTCVS 2000)</td>
<td>295 (16%)</td>
<td>13 days</td>
<td>97</td>
<td>96</td>
</tr>
<tr>
<td>Calafiore (JTCVS 2002)</td>
<td>33 (22%)</td>
<td>3 years</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Glineur (CIRC 2008)</td>
<td>299 (99%)</td>
<td>6 months</td>
<td>97</td>
<td>97</td>
</tr>
<tr>
<td>Dion (EJCTS 2000)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>161 (32%)</td>
<td>7 years</td>
<td>97</td>
<td>96</td>
</tr>
<tr>
<td>Tatoulis (Curr Op Cardiol 2011)</td>
<td>2176</td>
<td>10 years</td>
<td>91-97</td>
<td></td>
</tr>
<tr>
<td>Tatoulis (Curr Op Cardiol 2011)</td>
<td>440</td>
<td>10 years</td>
<td>89-95</td>
<td></td>
</tr>
</tbody>
</table>

1= vein graft patency 92%; 2= vein graft patency 72%

- ✔ Both ITA have similar patency when used to left sided coronaries
- ✔ Both ITA have similar patency when used as in situ or composite grafts
- ✗ INFERIOR PATENCY IF ANASTOMOSED TO AORTA
- ✗ INFERIOR PATENCY IF IMA ANASTOMOSED TO RCA
The right internal thoracic artery: is it underutilized?
James Tatoulis\textsuperscript{a,c}, Brian F. Buxton\textsuperscript{b,c} and John A. Fuller\textsuperscript{b} [2011]

(a) Patency (%)
- LITA–LAD \( n = 1965 \)
- RITA–LAD \( n = 149 \)

<table>
<thead>
<tr>
<th>Years post-op</th>
<th>LITA</th>
<th>1273</th>
<th>626</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>96.5%</td>
<td>97.8%</td>
<td>94.6%</td>
</tr>
<tr>
<td>10</td>
<td>98.4%</td>
<td>116</td>
<td>57</td>
</tr>
</tbody>
</table>

(b) Patency (%)
- LITA–Cx \( n = 292 \)
- RITA–Cx \( n = 436 \)

<table>
<thead>
<tr>
<th>Years post-op</th>
<th>LITA</th>
<th>RITA</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>88.6%</td>
<td>90.5%</td>
</tr>
<tr>
<td>10</td>
<td>96.1%</td>
<td>96.4%</td>
</tr>
<tr>
<td>10</td>
<td>211</td>
<td>291</td>
</tr>
<tr>
<td>9</td>
<td>93</td>
<td>138</td>
</tr>
</tbody>
</table>
SURVIVAL BENEFIT WITH TWO IMA GRAFTS?

Effect of arterial revascularisation on survival: a systematic review of studies comparing bilateral and single internal mammary arteries

David P Taggart, Roberto D’Amico, Douglas G Altman

Lancet 2001

4693 BIMA vs 11269 SIMA (from 7 databases)
Matched for age, gender, LV function, DM
HR for death with BIMA: 0.80 [95% CI=0.70 to 0.94]
NNT of 13-16 (to prevent one death)
Arterial Revascularization Trial (ART)

- 3102 patients randomized to Single or Bilateral ITA (plus supplemental vein grafts or RA)
- 28 centres in 7 countries from June 2004-Dec 2007
- Primary Outcome: All-cause mortality @ 10 years (2018)
- Secondary Outcomes: Mortality, MI and stroke @ 10 years
- Interim Analyses: 1 year (EHJ 2010), 5 years (NEJM 2016)
Randomized trial to compare bilateral vs. single internal mammary coronary artery bypass grafting: 1-year results of the Arterial Revascularisation Trial (ART)

David P. Taggart¹*, Douglas G. Altman², Alastair M. Gray³, Belinda Lees⁴,⁵, Fiona Nugara⁴, Ly-Mee Yu², Helen Campbell³ and Marcus Flather⁴,⁵, on behalf of the ART Investigators

- 30 day mortality 1.2%, 1 yr mortality 2.4%
- 1 year incidence of stroke, MI, repeat revasc all < 2%
- Sternal wound reconstruction: 0.6% SIMA vs 1.9% BIMA (NNH = 78)
Randomized Trial of Bilateral versus Single Internal-Thoracic-Artery Grafts

David P. Taggart, M.D., Ph.D., Douglas G. Altman, D.Sc., Alastair M. Gray, Ph.D., Belinda Lees, Ph.D., Stephen Gerry, M.Sc., Umberto Benedetto, M.D., and Marcus Flather, M.B., B.S., for the ART Investigators*
All Cause Mortality @ 5 years (Interim Analyses)

CABG MORTALITY @ 5 YEARS: SYNTAX 9%; NOBLE 9%; BEST 12%; CORONARY 14%

[NEJM 2016]

Single ITA: 8.4%
Bilateral ITA: 8.7%
HR: 1.04 (0.81-1.32) p = 0.77
Death, MI, Stroke @ 5 years (Interim Analyses)

Death / myocardial infarction / stroke (%)

Time from randomization (years)

Number at risk

<table>
<thead>
<tr>
<th></th>
<th>Single ITA</th>
<th>Bilateral ITA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1554</td>
<td>1548</td>
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<tr>
<td>1</td>
<td>1448</td>
<td>1452</td>
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<tr>
<td>2</td>
<td>1410</td>
<td>1422</td>
</tr>
<tr>
<td>3</td>
<td>1371</td>
<td>1373</td>
</tr>
<tr>
<td>4</td>
<td>1322</td>
<td>1317</td>
</tr>
<tr>
<td>5</td>
<td>1261</td>
<td>1266</td>
</tr>
</tbody>
</table>

Single ITA: 12.7%
Bilateral ITA: 12.2%
HR: 0.96 (0.79, 1.17) p=0.69

[NEJM 2016]
<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Single Graft</th>
<th>Bilateral Graft</th>
<th>Hazard Ratio (95% CI)</th>
<th>P Value for Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>94/1191 (7.9)</td>
<td>92/1177 (7.8)</td>
<td>0.99 (0.75–1.32)</td>
<td>0.62</td>
</tr>
<tr>
<td>Yes</td>
<td>36/363 (9.9)</td>
<td>42/371 (11.3)</td>
<td>1.14 (0.73–1.78)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td>0.08</td>
</tr>
<tr>
<td>&lt;70 yr</td>
<td>73/1128 (6.5)</td>
<td>64/1142 (5.6)</td>
<td>0.86 (0.62–1.20)</td>
<td></td>
</tr>
<tr>
<td>≥70 yr</td>
<td>57/426 (13.4)</td>
<td>70/406 (17.2)</td>
<td>1.32 (0.93–1.88)</td>
<td></td>
</tr>
<tr>
<td>Type of surgery</td>
<td></td>
<td></td>
<td></td>
<td>0.83</td>
</tr>
<tr>
<td>Off pump</td>
<td>54/618 (8.7)</td>
<td>56/641 (8.7)</td>
<td>0.99 (0.68–1.44)</td>
<td></td>
</tr>
<tr>
<td>On pump</td>
<td>75/928 (8.1)</td>
<td>75/891 (8.4)</td>
<td>1.05 (0.76–1.44)</td>
<td></td>
</tr>
<tr>
<td>Radial-artery graft</td>
<td></td>
<td></td>
<td></td>
<td>0.61</td>
</tr>
<tr>
<td>No</td>
<td>107/1208 (8.9)</td>
<td>109/1234 (8.8)</td>
<td>1.00 (0.76–1.30)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>22/339 (6.5)</td>
<td>23/300 (7.7)</td>
<td>1.18 (0.66–2.12)</td>
<td></td>
</tr>
<tr>
<td>No. of grafts</td>
<td></td>
<td></td>
<td></td>
<td>0.60</td>
</tr>
<tr>
<td>&lt;3</td>
<td>24/284 (8.5)</td>
<td>28/283 (9.9)</td>
<td>1.17 (0.68–2.02)</td>
<td></td>
</tr>
<tr>
<td>≥3</td>
<td>105/1263 (8.3)</td>
<td>104/1251 (8.3)</td>
<td>1.00 (0.76–1.31)</td>
<td></td>
</tr>
<tr>
<td>Ejection fraction</td>
<td></td>
<td></td>
<td></td>
<td>0.27</td>
</tr>
<tr>
<td>&lt;50%</td>
<td>43/379 (11.3)</td>
<td>50/360 (13.9)</td>
<td>1.24 (0.82–1.86)</td>
<td></td>
</tr>
<tr>
<td>≥50%</td>
<td>85/1131 (7.5)</td>
<td>80/1145 (7.0)</td>
<td>0.93 (0.68–1.26)</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>130/1554 (8.4)</td>
<td>134/1548 (8.7)</td>
<td>1.04 (0.81–1.32)</td>
<td>0.77</td>
</tr>
</tbody>
</table>
Why No Difference in ART in BITA vs SITA @ 5 years?

① Too early: 5-year interim analyses of 10 year outcome

② Vein graft failure: low until 5 years then accelerates

③ GBMT: >90% use (slows vein graft failure?)

④ X-over: 16% of BITA➔SITA; 4% SITA➔BITA

⑤ Radial Artery: 20% of SITA and BITA

⑥ Trend towards better survival < 70 years (p=0.08)
Survival % vs. Years After CABG

- **BITA**: n=1989, P < 0.001
- **SITA**: n=4147

Reoperation (% / year)

- Survival:
  - (1786) to 328
  - (2969) to 453

- Reoperation:
  - (1763) to 302
  - (2889) to 401
Effect of Bilateral Internal Mammary Artery on Long-Term Survival
A Meta-Analysis Approach

Gijong Yi, PhD; Brian Shine, MD; Syed M. Rehman, MD; Douglas G. Altman, DSc; David P. Taggart, PhD

15,583 patients followed for a mean of >9 years
Long-term Outcomes of Multiple Arterial Coronary Artery Bypass Grafting: A Population-Based Study of Patients in British Columbia, Canada

A

<table>
<thead>
<tr>
<th>Long-term Outcome</th>
<th>Cumulative Incidence, (%)</th>
<th>Hazard Ratio (95% CI)</th>
<th>MAG Better</th>
<th>LITA + SVG Better</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>32.1</td>
<td>27.0</td>
<td>0.79</td>
<td>(0.72-0.87)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Repeated revascularization</td>
<td>19.6</td>
<td>14.7</td>
<td>0.74</td>
<td>(0.66-0.84)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>5.9</td>
<td>4.2</td>
<td>0.63</td>
<td>(0.47-0.85)</td>
<td>.003</td>
</tr>
<tr>
<td>Stroke</td>
<td>3.2</td>
<td>3.0</td>
<td>0.82</td>
<td>(0.59-1.13)</td>
<td>.22</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>7.8</td>
<td>6.0</td>
<td>0.79</td>
<td>(0.64-0.98)</td>
<td>.03</td>
</tr>
<tr>
<td>Composite end point</td>
<td>23.6</td>
<td>20.0</td>
<td>0.82</td>
<td>(0.72-0.93)</td>
<td>.002</td>
</tr>
</tbody>
</table>

B

Mortality rates

C

Repeated revascularization

No. at risk
LITA + SVG MAG

<table>
<thead>
<tr>
<th>Year</th>
<th>LITA + SVG</th>
<th>MAG</th>
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<tbody>
<tr>
<td>0</td>
<td>5351</td>
<td>5580</td>
</tr>
<tr>
<td>5</td>
<td>4495</td>
<td>4695</td>
</tr>
<tr>
<td>10</td>
<td>3460</td>
<td>3635</td>
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<tr>
<td>15</td>
<td>2341</td>
<td>2494</td>
</tr>
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<td>20</td>
<td>1223</td>
<td>1360</td>
</tr>
<tr>
<td>25</td>
<td>217</td>
<td>250</td>
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</table>

No. at risk
LITA + SVG MAG

<table>
<thead>
<tr>
<th>Year</th>
<th>LITA + SVG</th>
<th>MAG</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>5351</td>
<td>5580</td>
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<tr>
<td>5</td>
<td>4274</td>
<td>4531</td>
</tr>
<tr>
<td>10</td>
<td>3191</td>
<td>3419</td>
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<tr>
<td>15</td>
<td>2073</td>
<td>2276</td>
</tr>
<tr>
<td>20</td>
<td>1012</td>
<td>1177</td>
</tr>
<tr>
<td>25</td>
<td>170</td>
<td>208</td>
</tr>
</tbody>
</table>
Associations Between Adding a Radial Artery Graft to Single and Bilateral Internal Thoracic Artery Grafts and Outcomes

Insights From the Arterial Revascularization Trial

BACKGROUND: Whether the use of the radial artery (RA) can improve clinical outcomes in coronary artery bypass graft surgery remains unclear. The ART (Arterial Revascularization Trial) was designed to compare survival after bilateral internal thoracic artery (BITA) over single left internal thoracic artery (SITA). In the ART, a large proportion of patients (≈20%) also received an RA graft instead of a saphenous vein graft (SVG). We aimed to investigate the associations between using the RA instead of an SVG to supplement SITA or BITA grafts and outcomes by performing a post hoc analysis of the ART.

METHODS: Patients enrolled in the ART (n=3102) were classified on the basis of conduits actually received (as treated). The analysis
ART: SITA/BITA: + RA (20%) vs +SVG (80%)
At 1 year no difference in functional patency of RA and SVG but marked superiority of RA at 8 years in patency and functional patency esp DM
Time-Varying Survival Benefit of Radial Artery Versus Vein Grafting: A Multiinstitutional Analysis

Thomas A. Schwann, MD, Robert F. Tranbaugh, MD, Kamellia R. Dimitrova, MD, Milo C. Engoren, MD, Ameer Kabour, MD, Darryl M. Hoffman, MD, Charles M. Geller, MD, Wilson Ko, MD, and Robert H. Habib, PhD

[ATS2014]
Three Arterial Grafts Improve Late Survival
A Meta-Analysis of Propensity-Matched Studies

- 10,287 patients followed from 3-17 years
- HR for Hospital Mortality for 3AG: 0.93 (95% CI 0.71-1.22: p=0.62)
- HR for Late Mortality for 3AG: 0.50 (95% CI 0.75-0.87: p<0.001)
Does Previous Transradial Catheterization Preclude Use of the Radial Artery as a Conduit in Coronary Artery Bypass Surgery?

**ABSTRACT:** The radial artery (RA) is a commonly used conduit for coronary artery bypass grafting, and recent studies have demonstrated that it provides superior long-term patency rates to the saphenous vein in most situations. In addition, the RA is also being used with increasing frequency in patients with poor saphenous vein availability or disease. However, prior instrumentation can lead to prolonged functional endothelial damage and reduced patency of RA for CABG.
Coronary Artery Bypass Grafting With and Without Manipulation of the Ascending Aorta

A Network Meta-Analysis

Dong Fang Zhao, BA\textsuperscript{a,b} J. James Edelman, PhD\textsuperscript{a,b,c} Michael Seco, MBBS\textsuperscript{a,b,c} Paul G. Bannon, PhD\textsuperscript{a,b,c,d,e} Michael K. Wilson, MBBS\textsuperscript{b,c,e} Michael J. Byrom, PhD\textsuperscript{a,b,c,d,e} Vinod Thourani, MD\textsuperscript{f} Andre Lamy, MD, MHS\textsuperscript{c,g} David P. Taggart, PhD\textsuperscript{h} John D. Puskas, MD\textsuperscript{i} Michael P. Vallely, PhD\textsuperscript{a,b,c,d,e}

\begin{itemize}
  \item 13 studies with 37,720 patients
  \item (i) ONCABG,
  \item (ii) OPCABG-PC,
  \item (iii) OPCABG-HS,
  \item (iv) ANOPCABG (NTAT)
  \item Effects on Death, Stroke, MI, Renal Failure, AF, Bleeding
\end{itemize}
The no-touch saphenous vein for coronary artery bypass grafting maintains a patency, after 16 years, comparable to the left internal thoracic artery: A randomized trial

Ninos Samano, MD, a Håkan Geijer, MD, PhD, b Mats Liden, MD, PhD, b Stephen Fremes, MD, MSc, c Lennart Bodin, PhD, d and Domingos Souza, MD, PhD a

TABLE 2. Ratio of number of patent grafts to total number of grafts for the 2 surgical techniques at 3 follow-up timepoints

<table>
<thead>
<tr>
<th>Variable (y)</th>
<th>Conventional</th>
<th>No-touch</th>
<th>Group difference in % patency*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>8.5</td>
<td>8.5</td>
<td>8.5</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

| No. of patients | 46 | 37 | 27 | 45 | 37 | 27 | 0.23 | 0.05 | 0.06 |
| Grafts         |    |    |    |    |    |    |      |      |      |
| Single         | 96/107 (90) | 68/87 (78) | 41/63 (65) | 103/109 (94) | 78/87 (90) | 55/67 (82) | 0.23 | 0.05 | 0.06 |
| Sequential     | 16/20 (80) | 10/14 (71) | 5/9 (56) | 15/15 (100) | 14/14 (100) | 7/8 (87) | 0.12 | 0.10 | 0.29 |
| All            | 112/127 (89) | 78/101 (77) | 46/72 (64) | 118/124 (95) | 92/101 (91) | 62/75 (83) | 0.08 | 0.01 | 0.03 |

A randomized comparison of the Saphenous Vein Versus Right Internal Thoracic Artery as a Y-Composite Graft (SAVE RITA) trial: One-year angiographic results and mid-term clinical outcomes

Ki-Bong Kim, MD, PhD, a Ho Young Hwang, MD, PhD, a Seokyoung Hahn, PhD, b Jun Sung Kim, MD, c and Se Jin Oh, MD d

TABLE 2. One-year angiographic patency rates of distal anastomoses

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total (n = 215)</th>
<th>SV group (n = 108)</th>
<th>RITA group (n = 107)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall grafts</td>
<td>745/765 (97.4)</td>
<td>375/383 (97.9)</td>
<td>370/382 (96.9)</td>
<td>.362*</td>
</tr>
<tr>
<td>Grafts using LITA</td>
<td>263/263 (100)</td>
<td>134/134 (100)</td>
<td>129/129 (100)</td>
<td>—</td>
</tr>
<tr>
<td>Grafts using second conduit</td>
<td>436/449 (97.1)</td>
<td>238/245 (97.1)</td>
<td>198/204 (97.1)</td>
<td>&lt;.001†</td>
</tr>
<tr>
<td>Grafts using third conduit</td>
<td>46/53 (86.8)</td>
<td>3/4 (75.0)</td>
<td>43/49 (87.8)</td>
<td>.443‡</td>
</tr>
</tbody>
</table>

Data presented as n/total (%). SV, Saphenous vein; RITA, right internal thoracic artery; LITA, left internal thoracic artery. *P value using chi square test for inequality. †P value using z-test for noninferiority. ‡P value using Fisher’s exact test for inequality.
Venous External Support Trial

Friday 13th

Randomized Trial
Fleet
Exteral Support
Safety
Usage
Cares

RIFSVC

CRBST
HAV VEST venous external support trial
VEST is BEST
For you print: IN VEST is THE BEST

Penis
Ejaculation
yamai ben-gur
The VEST External Stent for SVG

Mechanical Properties:
✓ Cobalt Chromium Alloy
✓ Radial Elasticity (Kink and Crush resistant)
✓ Axial Plasticity (adjust from 3-6 cm to 10-22 cm)
✓ Maintains its in situ configuration without fixation

Effects of Fluent Stent on Vein:
✓ REDUCES diameter by around 10%
✓ REDUCES lumen irregularities and flow discrepancies
✓ REDUCES wall tension
✓ REDUCES size mismatch vs native coronary artery
✓ Prevents vein dilatation post implantation

One minute to implant and no other change in technique needed
A Randomized Trial of External Stenting for Saphenous Vein Grafts in Coronary Artery Bypass Grafting

30 patients undergoing CABG x 3 (IMA + SVG x2)
One SVG randomized to Stent other SVG act as Control
All had excellent flow prior to chest closure (TTFM measurement)
1 year angio: IMA 100% patent
1 year angio: 18% Control SVG occluded (7% RCA and 25% Cx)
1 year angio: 30% Stented SVG occluded (46% RCA and 18% Cx)
Highest failure rate where metallic clips used in stent and fixation of proximal or distal anastomoses
Patent SVG: higher rate of perfect patency with Stents (81% vs 48%)
Stented SVG significant reduction in intimal hyperplasia
RCA: NO STENT

OM: NO STENT

RCA: STENT

OM: STENT
Stent improves perfect patency and lumen regularity, haemodynamic flow (OSI) with decreased IH
Stented

Non Stented

Smaller smoother intima
Smaller media
Greater lumen regularity
A prospective study of external stenting of saphenous vein grafts to the right coronary artery: the VEST II study

David P. Taggart\textsuperscript{a,b}, Sanaz Amin\textsuperscript{a,b,c}, Jasmina Djordjevic\textsuperscript{b}, Evangelos K. Oikonomou\textsuperscript{c}, Sheena Thomas\textsuperscript{c}, Anna-Maria Kampoli\textsuperscript{d}, Nikant Sabharwal\textsuperscript{a,c}, Charalambos Antoniades\textsuperscript{a,c} and George Krasopoulos\textsuperscript{a,b}

30 patients: No fixation or metallic clips: 6 month patency 86%
VEST III

- 180 patient RCT: Enrolment Complete January 2017
- Same method as VEST I (IMA + SVG x2 (one with stent)
- Primary end point: Perfect angiographic patency at 2 years
- Secondary end points: CT angio at 6 months and IVUS at 2 years

Interim analyses of Angiographic Patency:
- first 90 patients @ 6 months (AATS 2017)
- Patency: 90% both stented and nonstented groups
SAME PATIENT @ 1 and 5 YEARS
Stented SVG to OM, Nonstented SVG to RCA
3 SVG in Same Patient @ 5 years:

A: NO Stent  
B: NO Stent  
C: Stent
Optimal Conduit Strategy in 2017
SUMMARY and CONCLUSIONS

① ✔ A single ITA to LAD improves survival and reduces all MACCE

② ✔ Angiographic Patency of BITA are far superior to SVG

③ ✗ ART: @ 5 yr interim analysis showed no clinical benefit of BITA: Confounding factors: Too early, X-overs, High use GDMT, RA

④ ✔ Several meta-analyses of PS studies suggesting survival benefit of BITA over long-term: ART at 10-15 years ?

⑤ ✔ Largest study of 3 vs 2 arterial grafts suggests survival benefits out to 17 years

⑥ ✔ Skeletonized BITA reduce risk of sternal wound complications

⑦ SVG (80% of all grafts): Role of better preservation solutions ?, no touch harvest technique ?, composite from ITA ?, external stents ?
Vein Graft Remodeling: 2 Distinct Phases

✓ EARLY
✓ shear induced remodeling → luminal enlargement

✓ LATE
wall tension induced remodeling → wall thickening and stiffening
intimal hyperplasia
atherosclerosis

80% of CABG Grafts are SVG: \( \frac{3}{4} \) occluded or diseased by 10 yrs
Randomized comparison of the clinical Outcome of single versus Multiple Arterial grafts: the ROMA trial.

Mario Gaudino¹, John H. Alexander², Karla Ballman³, Faisal G. Bakaeen⁴, Fabio Barili⁵, Antonio Maria Calafiore⁶, Piroze Davierwala⁷, Steven Goldman⁸, Peter Kappetein⁹, Roberto Lorusso¹⁰, Darren Mylotte¹¹, Domenico Pagano¹², Marc Ruel¹³, David P Taggart¹⁴, Thomas Schwann¹⁵, Hisayoshi Suma¹⁶, Robert F. Tranbaugh¹, Stephen Fremes¹⁷. [EJCTS 2017]

- 4300 patients in > 25 international centres
- 2nd arterial graft either ITA or RA (surgeon preference)
- Primary outcome composite of death, stroke, MI, repeat revasc
- Long –term follow up
Pedicled and skeletonized single and bilateral internal thoracic artery grafts and the incidence of sternal wound complications: Insights from the Arterial Revascularization Trial

Umberto Benedetto, MD, PhD, Douglas G. Altman, DSc, Stephen Gerry, MSc, Alastair Gray, PhD, Belinda Lees, BSc, PhD, Rafal Pawlaczyk, PhD, Marcus Flather, MD, and David P. Taggart, MD, PhD, on behalf of the Arterial Revascularization Trial investigators

Any sternal wound complication (%)

Sternal wound reconstruction (%): Skeletonized had x 2 insulin dependent DM
Direct Anastomosis of the Bilateral Internal Mammary Artery to the Distal Coronary Artery, Without a Magnifier, for Severe Diffuse Coronary Atherosclerosis

By Akio Suzuki, M.D., Earle B. Kay, M.D., and James D. Hardy, M.D.

- 43 patients (10 BIMA):
- Flow measurements at surgery
- Early angiography: patency 97%

Bilateral Internal Mammary Artery and Distal Coronary Artery Bypass Procedures

<table>
<thead>
<tr>
<th>Procedure Description</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Double internal mammary artery–distal coronary artery anastomosis</td>
<td>6</td>
</tr>
<tr>
<td>1. RIMA–PD (RCA)</td>
<td>5</td>
</tr>
<tr>
<td>LIMA–AD</td>
<td></td>
</tr>
<tr>
<td>2. RIMA–AD</td>
<td>1</td>
</tr>
<tr>
<td>LIMA–LB</td>
<td></td>
</tr>
<tr>
<td>B. Double internal mammary artery–distal coronary artery anastomosis plus saphenous vein graft</td>
<td>4</td>
</tr>
<tr>
<td>1. RIMA–LB</td>
<td>2</td>
</tr>
<tr>
<td>LIMA–PD (CF) Saphenous vein graft to RCA</td>
<td></td>
</tr>
<tr>
<td>2. RIMA–AD</td>
<td>2</td>
</tr>
<tr>
<td>LIMA–PD (CF) Saphenous vein graft to RCA</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>
Percutaneous Coronary Intervention versus Coronary-Artery Bypass Grafting for Severe Coronary Artery Disease

Patrick W. Serruys, M.D., Ph.D., Marie-Claude Morice, M.D., A. Pieter Kappetein, M.D., Ph.D., Antonio Colombo, M.D., David R. Holmes, M.D., Michael J. Mack, M.D., Elisabeth Stähle, M.D., Ted E. Feldman, M.D., Marcel van den Brand, M.D., Eric J. Bass, B.A., Nic Van Dyck, R.N., Katrin Leadley, M.D., Keith D. Dawkins, M.D., and Friedrich W. Mohr, M.D., Ph.D., for the SYNTAX Investigators*

Strategies for Multivessel Revascularization in Patients with Diabetes


Everolimus-Eluting Stents or Bypass Surgery for Left Main Coronary Artery Disease


Percutaneous coronary angioplasty versus coronary artery bypass grafting in treatment of unprotected left main stenosis (NOBLE): a prospective, randomised, open-label, non-inferiority trial

Timo Makikallio, Niels R Holm, Mitchell Lindsay, Mark S Spence, Andrejs Erglis, Ian B A Menown, Thor Travig, Markku Eskola, Hannu Romppanen, Thomas Kellerth, Jan Raukka, Lisette O Jensen, Gintaras Kalinauskas, Rikard B A Linder, Markku Pentikainen, Anders Hervold, Adrian Banning, Azfar Zaman, Jarmen Cotton, Erlend Erikson, Sulev Margus, Henrik T Sorensen, Per H Nielsen, Matti Niemelä, Kari Kervinen, Jens F Lassen, Michael Maeng, Keith Oldroyd, Geoff Berg, Simon J Walsh, Colm G Hanratty, Indulis Kumsars, Peteris Stradiņš, Terje K Steigen, Ole Frøbø, Alastair N J Graham, Petter C Endresen, Matthias Corbascio, Olli Kajander, Uday Trivedi, Juhana Hartikainen, Vesa Anttila, David Hildick-Smith, Leif Thuesen, Evald H Christiansen, for the NOBLE study investigators*
BITA Grafting: ART and the Evidence in 2017

David P Taggart MD PhD FRCS
Professor of Cardiovascular Surgery
University of Oxford

(i)Clinical: Cardiac Surgeon
(ii)Academic: PI or Co-PI of Several CABG trials, ESC/EACTS Guideline Writer
(iii)Commercial: Advisor to VGS, Medistim, Medtronic, Somahlution, Cardioguard