PCI IN DIABETIC PATIENT

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Euromedica ‘Kyanous Stavros, THESSALONIKI
Revascularisation in Diabetes Mellitus

• Heartwire (www.theheart.org) Nov 1999
  • “Despite stents, diabetic patients undergoing PCI still face higher death rates.”

• AHA Scientific Statement 1999
  • “Recent studies indicate that coronary angioplasty is less efficacious for patients with diabetes than for those without; these reports further reveal that CABG is the preferred therapy in patients with diabetes when invasive management is required.”
Recommendations for 2007:
Which diabetic patients should undergo PCI?

• Single-vessel disease
• No evidence of involvement of proximal or mid-LAD (i.e., no LIMA)
• Patients with 2 or 3 highly discrete lesions without evidence of diffuse atherosclerosis (i.e., “low risk”)
• Patients with important contraindications to CABG
  – Previous CABG with patent LIMA
  – Advanced age
The Problem

- At least 65 percent of people with diabetes mellitus die of some form of heart disease or stroke.
  - Versus < 50% of those without DM
  - Often the death is at an earlier age

- Heart disease death rates among adults with diabetes are two to four times higher than the rates for adults without diabetes.

_NIDDK/NIH_, (diabetes.niddk.nih.gov)
Diabetic Vascular Pathology

↑ plasma coagulation
Altered response to arterial injury
Diminished fibrinolysis
↓ endothelial thromboresistance
Platelet hyperreactivity (diabetic thrombocytopenia)
↑ platelet aggregation and adhesion

Features of DM promote risk for ACS

- Prothrombotic
- Proinflammatory states,
- Endothelial dysfunction
- Metabolic disorders
  - hyperglycaemia,
  - dyslipidaemia,
  - obesity,
  - insulin resistance
  - Oxidative stress,

Purported mechanisms that contribute to increased platelet aggregation in DM

- Hyperglycaemia
  - May induce the expression of the surface adhesion molecule P-selectin,
  - Promotes glycation of platelet surface proteins
    - Consequent decrease in membrane fluidity
    - Platelet adhesion increase,
  - Activation of protein kinase C,
  - Possible direct osmotic effects
  - Promotes atherothrombosis
    - Oxidation of amino groups,
    - Formation of advanced glycation endproducts,
    - Endothelial dysfunction,
    - Subendothelial cellular proliferation,
    - Increased matrix expression

Purported mechanisms that contribute to increased platelet aggregation in DM

- Potential mechanisms of drug resistance
  - Increased expression of the platelet receptor glycoprotein (GP) IIb/IIIa
  - Up-regulation of platelet P2Y12 receptor signalling (theinopyridines)
  - Increased platelet turnover (ASA)

- Other metabolic conditions
  - Obesity via insulin resistance
    - May increase intracellular calcium concentration
    - May impair the response to nitric oxide.
  - Augmented cytosolic calcium concentration,
  - Increased oxidative stress)
  - Dyslipidaemia,
  - Systemic inflammation
  - Endothelial dysfunction

ACS mortality in patients with DM

Figure 3. Cumulative Incidence of All-Cause Mortality Through 1 Year After ACS

Donohoe, JAMA 2007
Trends in post ACS mortality and DM

Early mortality of diabetic and non-diabetic patients with acute myocardial infarction: Historical perspective

Pre CCU era (<1962)

CCU era (1962–1984)

Thrombolyis (1984–1996)

Primary PCI (since 1996)

Early mortality (%)

Proportion of diabetics in ACS patients (%)

Soier et al. Lancet 1974
Barbash et al. JACC 1993
Kagawa et al. Am J Cardiol 2007

Radke et al. European Heart Journal 2010
Acute STE MI approaches

- Meta-analysis of the Fibrinolytic Therapy Trialists’ Collaborative Group I
  - 21,659 subjects 2236 of whom were diabetic
  - greater than twofold survival benefit at 35 days among diabetic patients
    - corresponding to 3.7 lives for those with DM and 1.5 lives saved in those without DM per 100 patients treated.

- Primary PCI
  - 367 diabetic patients enrolled in 11 randomised trials
  - Primary PCI had lower event rates (9.2% vs. 19.3%, p <0.05).
  - Overall, the benefit of primary PCI over thrombolytic therapy was greater in diabetic patients compared with non-diabetic patients (numberneeded-to-treat [NNT] 10 and 16, respectively).
Revasc after ACS - Euro Heart Study

- 3488 patients 2/3 with unstable CAD followed for 1 year
  - 2063 non-DM
  - 1425 DM

- Revascularization was of no benefit in non-DM patients but DM patients with significant reductions in
  - Mortality (5.7 vs. 8.6%)
  - Composite of death, MI, or stroke (9.9 vs. 16.9%)

- Significant interaction between DM status and effect of revasc

- Drove European guidelines to recommend an early invasive strategy for all DM patients presenting with ACS

Euro Heart Study

Impact of Diabetes on Outcomes After PCI With DES in Relation to CAD Complexity

Pooled analysis of 6,081 patients from 4 all-comers trials that included use of newer-generation DES in 75% and analysis by SYNTAX score.

<table>
<thead>
<tr>
<th>Outcomes at 2 Years:</th>
<th>HR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes vs No Diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MACE</td>
<td>1.25</td>
<td>1.03-1.53</td>
</tr>
<tr>
<td>TLR</td>
<td>1.54</td>
<td>1.18-2.01</td>
</tr>
<tr>
<td>TVR</td>
<td>1.38</td>
<td>1.08-1.76</td>
</tr>
<tr>
<td>Cardiac Death</td>
<td>1.41</td>
<td>0.96-2.07</td>
</tr>
<tr>
<td>MI</td>
<td>0.89</td>
<td>0.64-1.22</td>
</tr>
</tbody>
</table>

**Conclusion:** Diabetic patients are at higher risk for repeat procedures and MACE than nondiabetic patients after PCI, regardless of disease complexity.


The Source for Interventional Cardiovascular News and Education
BARI 2D

• 2368 subjects presenting for evaluation of coronary disease randomized to medical therapy vs revascularization and to either insulin sensitization or insulin provision therapy in a 2x2 manner

• At 5 years no survival benefit with prompt revascularization

• There was reduction in subsequent MI only for those undergoing coronary artery bypass as revascularization (22.4% vs 32.5%). Most of this benefit was in the cohort receiving insulin.

Bari Study Group NEJM 2009
Diabetes and Clopidogrel-Induced Antiplatelet Effects

Loading Phase of Treatment

- DM
  - 38% Non-responders
  - 6% Low responders
  - 56% Responders

- No DM
  - 14% Non-responders
  - 8% Low responders
  - 78% Responders

24h post 300 mg LD

- P = 0.04

Maintenance Phase of Treatment

- ADP 20 μmol/L
  - T2DM: 62.9
  - No DM: 43.0

- ADP 6 μmol/L
  - T2DM: 41.5
  - No DM: 31.8

- P = 0.001
- P < 0.0001

ADP=Adenosine Diphosphate; DM=Diabetes Mellitus; LD=Loading Dose; MD=Maintenance Dose; T2DM=Type 2 Diabetes Mellitus

1Angiolillo DJ et al. Diabetes 2005;54:2430-2436
CV thrombotic Events by Diabetic Status

- No Diabetes (N=10,462)
- Diabetes (N=3,146)

Event Rate, %

- Mortality: P<0.001
- CVD/MI/CVA: P<0.001
- New MI: P<0.001
- Stent Thrombosis: P<0.001

CVD = Cardiovascular Death, MI = Myocardial Infarction, CVA = Stroke

Subgroup of Patients with Diabetes: LD Phase - Platelet Function Measures

Subgroup of Patients with Diabetes: MD Phase - Platelet Function Measures

PRINCIPLE
TIMI 44

IPA with 20 μmol/L ADP, %

<table>
<thead>
<tr>
<th></th>
<th>Day 15 and 29</th>
<th>Day 15</th>
<th>Day 29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clopidogrel Diabetics</td>
<td>39.1</td>
<td>35.3</td>
<td>43.5</td>
</tr>
<tr>
<td>Prasugrel Diabetics</td>
<td>59.6</td>
<td>63.0</td>
<td>55.9</td>
</tr>
</tbody>
</table>

P<0.001 P=0.005 P=0.36


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### Diabetic Subgroup: Primary End Point Reduction

**CV Death, NF MI or NF Stroke**

<table>
<thead>
<tr>
<th></th>
<th>Clopidogrel</th>
<th>Prasugrel</th>
<th>Reduction in Risk (%)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No DM (n = 10,462)</td>
<td>10.6</td>
<td>9.2</td>
<td>14</td>
<td>0.02</td>
</tr>
<tr>
<td>All DM (n = 3,146)</td>
<td>17.0</td>
<td>12.2</td>
<td>30</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>DM No Insulin (n = 2,370)</td>
<td>15.3</td>
<td>11.5</td>
<td>26</td>
<td>0.009</td>
</tr>
<tr>
<td>DM On Insulin (n = 776)</td>
<td>22.2</td>
<td>14.3</td>
<td>37</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Insulin therapy was identified at time of randomization.

CV = Cardiovascular; DM = Diabetes Mellitus; HR = Hazard Ratio; MI = Myocardial Infarction; NF = Nonfatal

Wiviott SD et al. Circulation 2009;119:1626-1636
Patients With Diabetes vs Patients Without Diabetes: Stent Thrombosis (ARC Definite or Probable)

- HR 0.52 (0.33-0.84), P = 0.007
  - Clopidogrel: 3.6
  - Prasugrel: 2.0
- HR 0.45 (0.31-0.65), P < 0.001
  - Clopidogrel: 2.0
  - Prasugrel: 0.9

P interaction = 0.63. Cumulative Kaplan-Meier estimates of the rates of key study end points during the follow-up period.

ARC = Academic Research Consortium, DM = Diabetes Mellitus, HR = Hazard Ratio.

Ticagrelor

- First in class cyclopentyltriazolopyrimidine,
  - direct-acting (i.e. no metabolism is required) oral agent and
  - reversible P2Y12 inhibitor
  - more prompt and potent platelet inhibitory effects than clopidogrel.

**PLATO (Platelet Inhibition and Patient Outcomes) - 18624 ACS**
- ticagrelor compared with clopidogrel (300–600 mg) loading
- Composite endpoint of death from vascular causes, MI or stroke at 12 months
  - Primary outcome (10.2 vs. 12.3%; HR = 0.84; P = 0.0001)
  - cardiovascular death (4.0 vs. 5.1%; HR = 0.79; P = 0.001)
  - definite/probable stent thrombosis (2.2 vs. 2.9%; HR = 0.75; P = 0.02)
  - major bleeding (11.6 vs.11.2%; HR = 1.04; P = 0.43),
  - Major bleeding not related to CABG was greater with ticagrelor (4.5 vs. 3.8%; HR = 1.19; P = 0.03).

Wallentin et al. NEJM 2009
Plato Substudy of diabetic patients

- 18,624 patients randomized in the PLATO

- 4,662 (25%) were reported as having DM by the investigators

- Analysis highlights issues of trying to draw conclusions from trial data subsets

PLATO DM vs no DM

Primary endpoint death mi stroke

PLATO – Bleeding risk in DM patients

1 Year Mortality in Patients with Diabetes Following PCI with and without Abciximab

EPIC, EPILOG, and EPISTENT - Meta-Analysis

- Placebo: n = 574
- Abciximab: n = 888

Death (%) vs Days of Randomization

\[ \downarrow \text{2.0%} \\
p = 0.031 \]

Bhatt DL et al. JACC 2000; 35:922-26
Platelet therapies in ACS for DM IIb/IIIa in DM meta analysis

6 trials n=6458 all with low use of P2Y12 inhibitors
26% reduction (6.2 TO 4.8) in mortality vs PLACEBO
70% reduction (4.0 TO 1.2) in mortality for those with PCI

EARLY- ACS – An overall negative trial with increased bleeding risk
2860/ 9406 subject with DM (11.7 vs 13.8) p=NS
High use of P2Y12 inhibitors

Roffi Circulation 2001; Giugliano NEJM 2009
Relationship Between Restenosis and Mortality In Diabetic Patients

- 513 diabetic pts underwent 6 month f/u angio and long-term clinical f/u
- 10-yr survival
  - No restenosis: 24%
  - Non-occlusive: 35%
  - Occlusive: 59%
- Occlusive (but not non-occlusive) restenosis associated with strong, independent risk of 10-year mortality (RR 2.4)

Meta-analysis: BMS vs DES in Patients With Diabetes

P < .00001
HR = 0.13 (0.09-0.20)

BMS
N = 611

DES
N = 530

P < .00001
HR = 0.23 (0.16-0.33)

Population, %

In-stent Restenosis

TLR

Pooled SPIRIT/COMPARE: 2-Year ARC
Definite/Probable Stent Thrombosis

Pooled SPIRIT/COMPARE: 2-Year ARC
Definite/Probable Stent Thrombosis

RESOLUTE Pooled Patient Level Analysis

R-ZES in Non-DM (n = 3595), NIDDM (n = 1080) and IDDM (n = 455)

<table>
<thead>
<tr>
<th>Clinical Event Category</th>
<th>Non-DM</th>
<th>NIDDM</th>
<th>IDDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinically driven TLR, %</td>
<td>2.9</td>
<td>3.1</td>
<td>6.3</td>
</tr>
<tr>
<td>Cardiac Death/TV-MI, %</td>
<td>3.6</td>
<td>3.8</td>
<td>6.6</td>
</tr>
<tr>
<td>ARC Def/Prob stent thrombosis, %</td>
<td>0.7</td>
<td>0.8</td>
<td>1.5</td>
</tr>
</tbody>
</table>

P values are adjusted with propensity score quintiles.

Primary Endpoint: Target Vessel Failure (TVF): Composite of Cardiac Death, Target vessel MI or Ischemia-Driven TVR at 1-Year
Primary End Point: Target Vessel Failure Rate at 1 Year

- PES HR [95%CI] = 1.64 [1.09-2.47]
- EES

P=0.02 by log-rank test
P_M=0.58 by P-M test
P_S=0.005

Cumulative Incidence (%)

0 2 4 6 8 10

*5.9%

*3.2%

Number at risk

<table>
<thead>
<tr>
<th></th>
<th>Months</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PES</td>
<td>914</td>
<td>841</td>
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<tr>
<td>EES</td>
<td>916</td>
<td>856</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>PES</td>
<td>818</td>
<td>789</td>
</tr>
<tr>
<td>EES</td>
<td>846</td>
<td>820</td>
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<td>12</td>
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<td>PES</td>
<td>713</td>
<td>736</td>
</tr>
<tr>
<td>EES</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Events calculated with Kaplan-Meier methods and compared with the use of the log-rank test. Differs slightly from graph which were calculated as categorical variables and compared with use of Chi-Square test.
Stent Thrombosis Rate at 1 Year

HR [95%CI] = 5.08 [1.74-14.87]
P<0.001 by log-rank test

Cumulative Incidence (%)

<table>
<thead>
<tr>
<th>Months</th>
<th>PES</th>
<th>EES</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>914</td>
<td>916</td>
</tr>
<tr>
<td>3</td>
<td>845</td>
<td>858</td>
</tr>
<tr>
<td>6</td>
<td>827</td>
<td>848</td>
</tr>
<tr>
<td>9</td>
<td>801</td>
<td>825</td>
</tr>
<tr>
<td>12</td>
<td>726</td>
<td>738</td>
</tr>
</tbody>
</table>

*Events calculated with Kaplan-Meier methods and compared with the use of the log-rank test. Differs slightly from graph which were calculated as categorical variables and compared with use of Chi-Square test.
**Tuxedo India Conclusions**

In this largest DES vs DES trial in diabetics comparing PES vs EES

**Primary End Point**

1. PES (Taxus) did not meet the non inferiority criteria when compare to EES (Xience).
2. EES (Xience) on superiority analysis proved superior.
3. This superiority was maintained in insulin requiring patients also.

**Stent thrombosis and myocardial rates were significantly higher with PES**
PCI or CABG?
Do Diabetics Have Increased Mortality After Multivessel Stenting?

<table>
<thead>
<tr>
<th>Study (yrs f/u)</th>
<th>Type of Study</th>
<th>N</th>
<th>Adjusted Hazard Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>BARI (8)</td>
<td>RCT</td>
<td>353</td>
<td>1.87 *</td>
</tr>
<tr>
<td>EAST (8)</td>
<td>RCT</td>
<td>90</td>
<td>1.56</td>
</tr>
<tr>
<td>BARI registry (5)</td>
<td>Obs</td>
<td>339</td>
<td>1.29</td>
</tr>
<tr>
<td>Duke databank (6)</td>
<td>Obs</td>
<td>770</td>
<td>1.27</td>
</tr>
<tr>
<td>Emory databank (5)</td>
<td>Obs</td>
<td>889</td>
<td>1.35 *</td>
</tr>
<tr>
<td>NNE (2)</td>
<td>Obs</td>
<td>2766</td>
<td>1.49*</td>
</tr>
<tr>
<td>ARTS (3)</td>
<td>RCT</td>
<td>210</td>
<td>1.70</td>
</tr>
<tr>
<td>SOS (1)</td>
<td>RCT</td>
<td>142</td>
<td>&gt;10</td>
</tr>
</tbody>
</table>

**Summary:** Stents do not appear to have significantly attenuated the mortality advantage of CABG in multivessel CAD.
BARI: Impact of Diabetes on Survival

balloon angioplasty era

5 year survival

BARI Subgroups

- Treated diabetic pts only

- **CABG 81%**
- **PTCA 65%**
CARDia Trial Design

Diabetic patients with multi-vessel disease or complex single vessel disease

Suitable for PCI or CABG

Inclusion and exclusion criteria met

CONSENT

Randomisation

Up to date CABG

Optimal PCI stent + abciximab

DES 72% BMS 28%

CARDia Coronary Artery Revascularisation in Diabetes Trial

Dr Akhil Kapur
London Chest Hospital, Bart's and The London NHS Trust, London, UK
On behalf of the CARDia Investigators
Friday 31st January 2003
**Individual 1 year**

<table>
<thead>
<tr>
<th>Event</th>
<th>PCI (n=254)</th>
<th>CABG (n=248)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>3.2% (n=8)</td>
<td>3.2% (n=8)</td>
</tr>
<tr>
<td>Non-fatal MI</td>
<td>9.8% (n=25)</td>
<td>5.7% (n=14)</td>
</tr>
<tr>
<td>Non-fatal stroke 16</td>
<td>2.8% (n=7)</td>
<td>0.4% (n=1)</td>
</tr>
</tbody>
</table>

P-values:
- Death: p=0.97
- Non-fatal MI: p=0.09
- Non-fatal stroke 16: p=0.07

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CARDia: Main conclusions

- No apparent difference between PCI and CABG at 1 year in:
  - Death
  - Composite of death, MI and stroke
- More repeat revascularization In the PCI group
- PCI may now be considered a reasonable strategy in diabetic patients with multivessel disease
- Longer follow up is needed
SYNTAX Trial

- CABG vs PCI in 3 vessel or LMCA disease
  - 60% patients were 3V CAD
  - 40% LMCA disease
  - Paclitaxel was the DES used

- How the score was calculated
  - Amount of segments involved
  - If a CTO was present and if so what type
  - Bifurcation vs trifurcation lesions
  - Ostial lesions
  - Tortuosity
  - Long segment disease
  - Small vessel disease
Results.

- **Composite primary endpoint was higher in PCI vs CABG (17.8% vs 12.4%)**
  - Death/MI/Repeat revascularization
  - This was driven by revascularization (13.5% vs 5.9%)
  - Death/Stroke/MI were comparable
  - At 3 and 5 year follow up, primary endpoint remained higher in PCI group (driven by revascularization)
Purpose of **FREEDOM**

- To determine if contemporary PCI with DES or CABG techniques, both with currently recommended ancillary medical therapies, is the superior approach to revascularization in patients with diabetes and multivessel CAD.
• Exclusion criteria
  – Prior CABG or valve surgery
  – Left main disease
  – *ST-elevation MI in last 72 hours*
  – Prior PCI in 6 months
- **DES: sirolimus or paclitaxel eluting.** Newer generations could be used if approved for use. **ASA and clopidogrel** for at least 12 months.
- CABG: encouraged arterial revascularization when able
- Medical therapy goals for both groups:
  - LDL <70
  - BP <130/80
  - HgbA1c <7%
SYNTAX SCORE

- **Tool to score complexity of CAD based on anatomy**
- There were 395 participants (20.9%) with a high SYNTAX score (>32), 839 (44.0%) with an intermediate score (22-32), and 662 (35.1%) with a low score (<22).
Results

A Primary Outcome

P=0.005 by log-rank test
5-Yr event rate: 26.6% vs. 18.7%

Years since Randomization

No. at Risk

<table>
<thead>
<tr>
<th></th>
<th>PCI</th>
<th>CABG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>953</td>
<td>947</td>
</tr>
<tr>
<td>1.0</td>
<td>848</td>
<td>814</td>
</tr>
<tr>
<td>2.0</td>
<td>788</td>
<td>758</td>
</tr>
<tr>
<td>3.0</td>
<td>625</td>
<td>613</td>
</tr>
<tr>
<td>4.0</td>
<td>416</td>
<td>422</td>
</tr>
<tr>
<td>5.0</td>
<td>219</td>
<td>221</td>
</tr>
</tbody>
</table>

Death, Myocardial Infarction, or Stroke (%)
Results

B  Death

P = 0.049 by log-rank test
5-Yr event rate: 16.3% vs. 10.9%

Death from Any Cause (%)

Years since Randomization

No. at Risk

<table>
<thead>
<tr>
<th></th>
<th>PCI</th>
<th>CABG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>953</td>
<td>947</td>
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<tr>
<td>1</td>
<td>897</td>
<td>855</td>
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<tr>
<td>2</td>
<td>845</td>
<td>806</td>
</tr>
<tr>
<td>3</td>
<td>685</td>
<td>655</td>
</tr>
<tr>
<td>4</td>
<td>466</td>
<td>449</td>
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<tr>
<td>5</td>
<td>243</td>
<td>238</td>
</tr>
</tbody>
</table>
STROKE

Years post-randomization

Stroke, %

PCI/DES

CABG

PCI/DES N 953
891 833 673 460 241

CABG N 947
844 791 640 439 230

Logrank P=0.034

5.2% CABG

2.4% PCI/DES

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REPEAT REVASCULARIZATION

PCI/DES

CABG

Repeat Revascularization, %

Months post-procedure

PCI/DES

CABG

13%

5%

Log rank P<0.0001

Repeat Revascularization, %

PCI/DES

CABG

Months post-procedure

PCI/DES N 944

CABG N 911

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Results

- Primary outcome analysis for DES type compared to CABG (898 pts)
  - Sirolimus-eluting (469 pts) at 5 yrs: 6.7% more events than CABG
  - Paclitaxel-eluting (394 pts) at 5 yrs: 6.5% more events than CABG
- No difference in 30 day major bleeding event: P=0.13
- ARF requiring dialysis at 30 days significantly higher in CABG group (P=0.02): 8 pts compared to 1 patient
Discussion - limitations

- **Low-prevalence subgroups**
  - Low statistical power to detect interactions between subgroups

- **Unblinded**
  - Investigators argue that this is less important given objective outcomes and similar medical therapy between groups

- **Generalizability: only 10% of screening population eligible, only half of those randomized**
  - Late Breaking Clinic Trial 2012: PI stated that of the eligible patients who declined randomization, *most requested PCI as reason for not wanting randomization*
  - Equipoise candidates for each procedure often not the case. Likely explains significant number of patients screened but not eligible for randomization
Annual and Cumulative Costs: Years 1 - 5

Δ costs = $7878

Δ costs = $3641

Cumulative Costs:

- CARG Annual Cost
- PCI Annual Cost
- CARG Cumulative Cost
- PCI Cumulative Cost

Year 1, Year 2, Year 3, Year 4, Year 5
"[In diabetic patients with complex disease,] CABG was of significant benefit as compared with PCI."

- Dr Valentin Fuster, PI and senior author

"I think the study is very convincing, and I think the guidelines will likely recognize that. There have been trends showing this before, such as the BARI-2D study with similar information showing that surgery was definitely better than medicine. I think that if you look at the anatomy—and all coronary disease is not the same—the anatomy [of diabetics] is imposing, and I think most of these patients go to surgery anyway. But I think this provides meaningful information to help us with these decisions."

- Dr David Williams

"Faced with a patient who is a candidate for either procedure, I would think long and hard about performing PCI at this point."

- Dr Alice Jacobs

*All comments from FREEDOM: CABG superior to PCI in diabetic patients with coronary disease (http://www.theheart.org/article/1469059.do)*
Several studies have compared outcomes for CABG and PCI, but most were done before the availability of stenting (2nd and 3rd generation).

Without the use of novel antiplatelet !!!!
Approaches to Improve Late DES Outcomes

1. Metallic DES with bioabsorbable polymers
2. Metallic DES, polymer-free
3. Bioresorbable vascular scaffold (BVS)
Several studies have compared outcomes for CABG and PCI, but most were done before the availability of stenting, which has revolutionized the latter approach.

1st generation

Stent Availability...
2nd generation
**3d generation**

**Biolimus-A9 Eluting Stent**

- Abluminal Bioabsorbable Polymer
- BSC Synergy stent
- Applied only to the abluminal surface
- Thinner strut (0.019")

**BioFreedom Stent (Biosensors)**

- Hypothesis: Polymer-free drug release via porous-eluting stents may reduce late events caused by polymer stent coatings.
- Potential advantages:
  - Avoid long term late adverse effects that might be attributable to the polymer
  - Improved surface integrity since there is no polymer to be sheared or pealed away from the stent struts
  - Possible shorter need of dual antiplatelet therapy

**Bioresorbable Vascular Scaffolds (BVS)**

- Igaki-Tamai
- BVS
- REVA
- BTI
- Biotronik

**DFS: Drug Filled Stent (Medtronic)**

- Drug elution controlled by diffusion physics
- Drug release through holes

Hellenic Institute of Cardiovascular Diseases

www.e-Cardio.gr
CABG in Patients with Diabetes

- CABG advantage depends on use of LIMA
- ↑ rates of procedure related morbidity
  - Renal failure
  - Wound infection
  - Sternal wound failure
  - increased stroke risk

  ARTS trial - 1 year CVA rate
  - CABG 6.3%  PCI 1.8%
Angiographic Patency after CABG: experience from CLEVELAND CLINIC DATABASE (565+511 days)

LIMA  RIMA  SVG  RADIAL

Khot u et al. Circulation 2004
Angiographic Patency after CABG: experience from CLEVELAND CLINIC DATABASE (565+511 days)

- LIMA
- RIMA
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- LIMA
- RIMA
- SVG
- RADIAL

Khot u et al. Circulation 2004
PCI with 3d generation DES and novel antiplatelet or CABG?

Thank you!!!!