Endovascular Approaches for PVD in Younger Patients: Do they have Worse Outcomes?

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DISCLOSURES

☐ Nothing to disclose for this presentation

Premature Peripheral Vascular Disease

Risk factors for premature peripheral vascular disease: Results for the National Health and Nutritional Survey, 1999-2002

John L. Nunez, M.D.* Eric Viragloeff, Ph.D.* Karen F. Lane, M.D.* Clyde A. Hines, M.D.* and Boston University School of Medicine

Uncommon Occurrence in patients younger than 60 years
✓ 2.1% in population < 60 years
✓ 12.0% in population > 60 years

Association with
Coronary artery disease
Hypertension
Smoking
Elevated Fibrinogen and Homocysteine

J Vasc Surg 2006;44:319-25

Premature Peripheral Vascular Disease

Atherosclerosis in the young: A virulent disease

Robert A. Proctor, M.D.* Anne K. Vassiliadis, R.N.* Gerhard L. Arendt, M.D.* and Pittsburgh University School of Medicine

Atherosclerotic cardiovascular disease in young patients appears to be a virulent disease process and is associated with a high rate of recurrent progressive disease.

Surgery, 1984;96:863-8
**Premature Peripheral Vascular Disease**

**No Agreement on Cutoff Age for Premature PVD: 40-60 yrs**

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>N</th>
<th>Age</th>
</tr>
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<tbody>
<tr>
<td>McCready et al.</td>
<td>1984</td>
<td>25</td>
<td>&lt;40</td>
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<tr>
<td>Olsen et al.</td>
<td>1988</td>
<td>99</td>
<td>&lt;45</td>
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<tr>
<td>Kwolek et al.</td>
<td>1992</td>
<td>60</td>
<td>&lt;60</td>
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<tr>
<td>Van Goor et al.</td>
<td>1995</td>
<td>29</td>
<td>&lt;40</td>
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<td>Toursarkissian et al.</td>
<td>2000</td>
<td>31</td>
<td>&lt;30</td>
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<tr>
<td>Salzberg et al.</td>
<td>2003</td>
<td>51</td>
<td>&lt;40</td>
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</table>

**Factors associated with early failure of infrainguinal lower extremity arterial bypass**

- NSQIP data from 1995-2003
- 14,788 Infrainguinal Bypass Grafts
- 723 acute graft failures (4.9%)

<table>
<thead>
<tr>
<th>Age</th>
<th>Early Failure Rate</th>
<th>OR (multivariate regression)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;51</td>
<td>8.21%</td>
<td>2.2</td>
<td>&lt;.001</td>
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<tr>
<td>51-60</td>
<td>5.26%</td>
<td>1.4</td>
<td>&lt;.001</td>
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<tr>
<td>61-70</td>
<td>4.52%</td>
<td>1.1</td>
<td>&lt;.150</td>
</tr>
<tr>
<td>&gt;70</td>
<td>4.37%</td>
<td>ref</td>
<td>ref</td>
</tr>
</tbody>
</table>

**National trends in lower extremity bypass surgery, endovascular interventions, and major amputations**

**Endovascular Interventions Increased Threefold**

- Medicare 1996-2006
- Bypass down 42%
- Major Amp down 30%

**Very Little Data exists on the Outcome of Endovascular Interventions in the YOUNG patient**
Percutaneous Transluminal Angioplasty in Adults Less Than 45 Years of Age With Premature Lower Extremity Atherosclerosis

- 32 patients < 45 years old with Iliac lesions
  - Only 83% Success rate
  - Only 70% Clinical Success Rate

  Cumulative Patency
  - 1 year 81%
  - 2 years 77%
  - 3 years 71%

  41% required secondary PTA or Bypass, most of them in 1st year

Results of Iliac Artery Stent Placement in Patients Younger than 50 Years of Age

- 42 patients <50 years old with Iliac lesions
  - 100% Success Rate
  - Primary Patency
    - 1 year 86%
    - 2 years 72%
    - 3 years 65%
  - Revisions
    - 12% surgical
    - 17% endovascular

Long-Term Follow-Up of Endovascular Treatment for Trans-Atlantic Inter-Society Consensus II Type B Iliac Lesions in Patients Aged <50 Years

- 60 patients <50 years old with Type B Iliac lesions
  - Only 93% Success Rate

  Primary Patency
  - 1 year 88%
  - 3 years 59%
  - 5 years 49%

  Predictors (Cox Univariate)
  - No comparison to >50
  - 45-50 years worse than <40

UPMC Review

- Characterize patients with premature PVD
- Compare outcomes of LER in different age groups
- Assess the impact of endovascular interventions
Impact of endovascular options on lower extremity revascularization in young patients

Cassio Iyad Oluwa Chace, MD, Michel S. MAKROM, MD, Luke E. MAROSS, MD, Robert Y. RICE, MD, George AI-KHOURY, MD, Iva S. CHAO, MD, Steven A. LEE, MD, and Rohit A. CHARE, MD, PitiBirgul, PA

Methods

Retrospective review (2000-2008)

All Patients with LER: Lower Extremity Revascularization with Age ≤ 60 @ first procedure

- 200 patients
- 290 limbs

Excluded:

- follow up < 3 months
- Incomplete Records

A group of controls age > 60 was selected from the same time period with

- Comparable indications: Claudication vs CLI
- Comparable type of intervention: Open vs Endo
  - 98 patients
  - 119 limbs

Population divided into 3 groups

- Group A: ≤ 50 year old
- Group B: 51-60 year old
- Group C: > 60 year old (Reference)

Patients demographics and comorbidities

Type of procedures: Open, Endovascular and Hybrid

Indications: Claudication vs Critical Limb Ischemia

Angio Review: Disease Level and Severity (TASC II)

Perioperative Morbidity and Mortality

Primary Patency, Primary Assisted-Patency and Secondary Patency rates

Limb salvage and survival

FU including ABI and Duplex: 1,3,6 and Q6 months
Statistical Methods

- Baseline comparison of the 3 groups:
  - Chi-square for categorical variables,
  - Kruskal-Wallis test for continuous variables
- Trends by age:
  - Cochran-Mantel-Haenszel test for categorical variables
  - JT test for continuous and nominal/ordinal variables
- Patency, limb salvage, survival: Kaplan-Meier approach
  Compared by means of the log-rank test for trends
- Cox proportional hazards regression to estimate risk ratios of clinical events in relation to age (stepwise modeling for covariate selection)

Patient Population

Patient Characteristics

<table>
<thead>
<tr>
<th>Patient Characteristics</th>
<th>Group A % (n=97)</th>
<th>Group B % (n=103)</th>
<th>Group C % (n=98)</th>
<th>p-value</th>
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<tbody>
<tr>
<td>Comorbidities</td>
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<tr>
<td>Diabetes</td>
<td>38.1</td>
<td>22.7</td>
<td>62.2</td>
<td>0.002</td>
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<tr>
<td>Type I diabetes</td>
<td>16.7</td>
<td>9.7</td>
<td>1.6</td>
<td>0.008</td>
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<tr>
<td>Hypertension</td>
<td>76.3</td>
<td>81.5</td>
<td>86.7</td>
<td>0.17</td>
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<td>Hypercholesterolemia</td>
<td>57.7</td>
<td>64.1</td>
<td>69.0</td>
<td>0.28</td>
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<tr>
<td>CAD</td>
<td>43.3</td>
<td>53.3</td>
<td>61.7</td>
<td>0.03</td>
</tr>
<tr>
<td>CHF</td>
<td>9.3</td>
<td>23.3</td>
<td>23.3</td>
<td>0.007</td>
</tr>
<tr>
<td>Prior CABG</td>
<td>10.3</td>
<td>25.5</td>
<td>34.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>COPD</td>
<td>11.3</td>
<td>24.3</td>
<td>22.7</td>
<td>0.05</td>
</tr>
<tr>
<td>ESRD</td>
<td>6.2</td>
<td>19.4</td>
<td>13.3</td>
<td>0.02</td>
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<tr>
<td>CRI</td>
<td>16.5</td>
<td>23.3</td>
<td>32.6</td>
<td>0.03</td>
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<tr>
<td>Stroke</td>
<td>6.2</td>
<td>18.4</td>
<td>21.8</td>
<td>0.007</td>
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<tr>
<td>Cancer</td>
<td>5.1</td>
<td>11.6</td>
<td>16.0</td>
<td>0.06</td>
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<tr>
<td>Morbid Obesity</td>
<td>21.2</td>
<td>11.2</td>
<td>17.4</td>
<td>0.23</td>
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<tr>
<td>Hypercoagulable state</td>
<td>15.8</td>
<td>4.8</td>
<td>3.1</td>
<td>0.004</td>
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<tr>
<td>Social History</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Smoking</td>
<td>82.5</td>
<td>78.6</td>
<td>62.2</td>
<td>0.003</td>
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<tr>
<td>Alcohol abuse</td>
<td>10.3</td>
<td>9.7</td>
<td>7.7</td>
<td>0.85</td>
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</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>Patients #</th>
<th>Limbs #</th>
<th>Mean Age (yrs)</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>97</td>
<td>139</td>
<td>45±5</td>
<td>56.7 %</td>
</tr>
<tr>
<td>B</td>
<td>103</td>
<td>151</td>
<td>56±3</td>
<td>65.0 %</td>
</tr>
<tr>
<td>C</td>
<td>98</td>
<td>119</td>
<td>73±8</td>
<td>63.3 %</td>
</tr>
</tbody>
</table>

- 298 patients and 409 Limbs
- 44% Claudicants
- 56% CLI
Primary Patency

- Cox Proportional Hazards (loss of patency)
  - Increased Age: HR 0.49, p = 0.003
  - ASA use: HR 0.68, p = 0.04
  - Endovascular: HR 1.77, p = 0.005

Endovascular Procedures Primary Patency

Limb Salvage Rates

- Freedom from Major Amputations
  - Cox Proportional Hazards (loss of limb)
    - Age > 60: HR 0.36, p = 0.05

Endovascular Limb Salvage Rates
Claudication Primary Patency

- 22 limbs in 14 patients <50 progressed from Claudication to CLI
- Mean time to progression: 22 months
- Open: 15 / Endo: 7
- Amputations: 6 (4 open / 2 endo)
- Claudicators:
  - Lower limb salvage rate at 2yrs in group A vs. B+C (p=0.05)

Claudication Conversion to CLI

<table>
<thead>
<tr>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>% (n=139)</td>
<td>% (n=151)</td>
<td>% (n=119)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

- Claudicant to CLI: 16 (22) 3 (5) 2 (2)

Multivariate models

- Age < 50 independent predictor of limb loss (vs. >60)
- Predictors of loss of primary patency:
  - Age < 50
  - Endovascular revascularization HR 1.77 p=.005
  - CLI on presentation
  - Claudication progression to CLI HR 3.34 p<.001
  - Fem-Pop distribution of disease
- Predictors of Reintervention
  - Age < 60

Survival
Social Security Administration Data

<table>
<thead>
<tr>
<th>Exact age</th>
<th>Death probability</th>
<th>Number of lives</th>
<th>Life expectancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>0.003646</td>
<td>94,075</td>
<td>33.11</td>
</tr>
<tr>
<td>46</td>
<td>0.003960</td>
<td>93,732</td>
<td>32.23</td>
</tr>
<tr>
<td>47</td>
<td>0.004316</td>
<td>93,361</td>
<td>31.35</td>
</tr>
</tbody>
</table>

Risk of mortality at 3 years = 1.1%

http://www.ssa.gov/OACT/STATS/table4c6.html#fn1

Conclusions

- Patients with PAD younger than 50 have a distinct risk profile
- Outcomes of LER in young adults whether endovascular or open remain inferior to older patients
- Endovascular interventions in young adults are associated with high failure rate and high limb loss rate
- Premature PVD patients with claudication are at risk for rapid progression to CLI after interventions
- Minimally invasive LER should be cautiously used in patients with premature PVD, primarily in patients with CLI with mostly conservative management for claudicants.