VSGNE Administrative Support

- Dawn Robinson

- support@vsgne.org
>38,000 Procedures Reported

CEA, CAS, oAAA, EVAR, LEB, PVI, TEVAR, Access
Vascular Quality Initiative

Growth of Participating Centers

259 Centers, 45 States + Ontario
as of 11/1/2013
15 Regional Quality Groups

Regional Groups Currently Organizing:
- Michigan
- Tennessee/Mississippi
- Minnesota
### Total Procedures Captured (as of 11/1/2013)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotid Endarterectomy</td>
<td>29,767</td>
</tr>
<tr>
<td>Carotid Artery Stent</td>
<td>4,195</td>
</tr>
<tr>
<td>Endovascular AAA Repair</td>
<td>11,600</td>
</tr>
<tr>
<td>Open AAA Repair</td>
<td>4,517</td>
</tr>
<tr>
<td>Peripheral Vascular Intervention</td>
<td>36,015</td>
</tr>
<tr>
<td>Infra-Inguinal Bypass</td>
<td>15,428</td>
</tr>
<tr>
<td>Supra-Inguinal Bypass</td>
<td>4,738</td>
</tr>
<tr>
<td>Thoracic and Complex EVAR</td>
<td>1,646</td>
</tr>
<tr>
<td>Hemodialysis Access</td>
<td>6,725</td>
</tr>
<tr>
<td>Lower Extremity Amputations</td>
<td>221</td>
</tr>
<tr>
<td>IVC Filter</td>
<td>265</td>
</tr>
</tbody>
</table>

Graph: VQI Monthly Procedure Volume

- Data points range from March 2013 to September 2013.
- The volume steadily increases from March 2013 to September 2013.
Recent Activity

- Post Approval Study for new devices for TEVAR treatment of descending dissection

- AHRQ grant by Phil Goodney: Matching Medicare claims data with VQI data to examine late events after CEA and CAS, to inform optimal patient selection

- Work groups for VQI growth, industry relations and cost/charge data collection
One Year Follow-up

- VQI and VSGNE require that a follow-up form be entered for at least 80% of patients at least 9 months after their procedure, based on in person or telephone visit.
VSGNE Center Comparison – 2011 Procedures
9 month or greater follow-up rate
(ofﬁce visit or phone call, excludes patients who died)

Mean 57%
(May, 2013)
VSGNE Center Comparison – 2011 Procedures
9 month or greater follow-up rate
(office visit or phone call, excludes patients who died)

Mean 62%
(October, 2013)
VQI Center Variation: 9 Month or Greater Follow-up
2011 Procedures with an Office or Phone Follow-up

Overall VQI 61%
VQI Region Variation: 9 Month or Greater Follow-up
2011 Procedures with an Office or Phone Follow-up

VQI Regional Quality Groups
VQI Procedure Variation: 9 Month or Greater Follow-up
2011 Procedures with an Office or Phone Follow-up

Cas: 58%
CeA: 60%
EvaR: 63%
HeMo: 56%
InFra: 63%
OAAA: 61%
Pvi: 61%
SupRa: 60%
TevaR: 65%
One Year Follow-up - Success

- Develop a clear plan with key roles
- Communicate the plan to all staff
- Include in performance evaluation
- Physician champion partners with data manager, emphasizes importance

- Develop mechanism to identify patients needing follow-up reporting
Determinants of amputation free survival after peripheral vascular intervention for critical limb ischemia


For the Vascular Study Group of New England

VSGNE Meeting
November 8, 2013
Objective

- Examine outcomes of PVI for CLI within the VSGNE

- Identify predictors of
  - Overall survival (OS)
  - Amputation free survival (AFS)
  - Freedom form amputation (FFA)
Methods

• Retrospective study of VSGNE PVI database

• Kaplan Meier analysis
  1. overall survival
  2. amputation
  3. percutaneous or surgical reintervention

• Univariate screen for predictors of OS, AFS and FFA

• Multivariate Cox proportional hazards model
Exclusions for indication

17 excluded for pathology not listed
12 excluded for aneurysmal pathology

PVI for claudication
N=2,214

PVI for acute ischemia
N=206

PVI for asymptomatic disease
N=106

PVI 2010-2011
N=3,878

PVI for CLI
N=1,443

Study Population
1,253 patients
PVI for CLI due to occlusive disease
N=1,414
## Patient characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N=771</strong></td>
<td></td>
</tr>
<tr>
<td>Male gender</td>
<td>58%</td>
</tr>
<tr>
<td>Non-white race</td>
<td>11%</td>
</tr>
<tr>
<td>Age ≥80</td>
<td>23%</td>
</tr>
<tr>
<td>Not living at home pre-operatively</td>
<td>7%</td>
</tr>
<tr>
<td>Not ambulatory pre-operatively</td>
<td>32%</td>
</tr>
<tr>
<td>Current or former smoker</td>
<td>76%</td>
</tr>
<tr>
<td> Current smokers</td>
<td>30%</td>
</tr>
<tr>
<td> Former smokers</td>
<td>46%</td>
</tr>
<tr>
<td>Insulin dependent diabetes</td>
<td>39%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>89%</td>
</tr>
<tr>
<td>COPD</td>
<td>19%</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>36%</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>21%</td>
</tr>
<tr>
<td>Renal function</td>
<td></td>
</tr>
<tr>
<td> Creatinine &lt;1.8</td>
<td>83%</td>
</tr>
<tr>
<td> Creatinine ≥1.8</td>
<td>7%</td>
</tr>
<tr>
<td> Dialysis</td>
<td>10%</td>
</tr>
<tr>
<td>Tissue loss</td>
<td>71%</td>
</tr>
<tr>
<td>Prior PVI</td>
<td>31%</td>
</tr>
<tr>
<td>Prior LEB</td>
<td>20%</td>
</tr>
<tr>
<td>Prior major amputation</td>
<td>8%</td>
</tr>
<tr>
<td>Preoperative medications</td>
<td></td>
</tr>
<tr>
<td> Anti-platelet</td>
<td>81%</td>
</tr>
<tr>
<td> Statin</td>
<td>68%</td>
</tr>
</tbody>
</table>
# of Vessels Treated

- 1 vessel: 49%
- 2 vessels: 35%
- 3 vessels: 12%
- ≥4 vessels: 5%
### Intervention by arterial segment and TASC class

<table>
<thead>
<tr>
<th>Type of PVI</th>
<th>Aorto-iliac</th>
<th>Femoral-popliteal</th>
<th>Tibial-peroneal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A/B</td>
<td>C/D</td>
<td>A/B</td>
</tr>
<tr>
<td>PTA alone</td>
<td>21%</td>
<td>18%</td>
<td>40%</td>
</tr>
<tr>
<td>Stent</td>
<td>64%</td>
<td>64%</td>
<td>32%</td>
</tr>
<tr>
<td>Stent-graft</td>
<td>8%</td>
<td>19%</td>
<td>2%</td>
</tr>
<tr>
<td>Atherectomy</td>
<td>8%</td>
<td>0%</td>
<td>25%</td>
</tr>
</tbody>
</table>
## Procedural outcomes and complications

<table>
<thead>
<tr>
<th>Variable</th>
<th>% (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical Result</strong></td>
<td></td>
</tr>
<tr>
<td>Successful</td>
<td>92% (2,246)</td>
</tr>
<tr>
<td>Residual stenosis &gt;30%</td>
<td>4% (91)</td>
</tr>
<tr>
<td>Failure to cross lesion</td>
<td>4% (101)</td>
</tr>
<tr>
<td><strong>Hematoma</strong></td>
<td></td>
</tr>
<tr>
<td>Minor</td>
<td>3.9% (55)</td>
</tr>
<tr>
<td>Moderate</td>
<td>0.8% (11)</td>
</tr>
<tr>
<td>Major</td>
<td>0.3% (5)</td>
</tr>
<tr>
<td><strong>Occlusion of access site</strong></td>
<td>0.3% (5)</td>
</tr>
<tr>
<td><strong>Distal embolization</strong></td>
<td>2.3% (33)</td>
</tr>
<tr>
<td><strong>Arterial perforation</strong></td>
<td></td>
</tr>
<tr>
<td>Iliac</td>
<td>0.4% (6)</td>
</tr>
<tr>
<td>Femoral-popliteal</td>
<td>0.5% (7)</td>
</tr>
<tr>
<td>Tibial-peroneal</td>
<td>0.1% (2)</td>
</tr>
<tr>
<td><strong>Complication requiring readmission</strong></td>
<td>5% (63)</td>
</tr>
<tr>
<td><strong>Discharge disposition</strong></td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>77% (1,072)</td>
</tr>
<tr>
<td>Rehabilitation facility</td>
<td>12% (160)</td>
</tr>
<tr>
<td>Nursing home</td>
<td>11% (159)</td>
</tr>
<tr>
<td>Other hospital</td>
<td>0.4% (5)</td>
</tr>
<tr>
<td>Dead</td>
<td>1% (16)</td>
</tr>
<tr>
<td>Major amputation</td>
<td>2.2%</td>
</tr>
</tbody>
</table>
## Univariate analysis of AFS at one-year

<table>
<thead>
<tr>
<th>Variable</th>
<th>Percent died at 1-year</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>if variable absent</td>
<td>if variable present</td>
</tr>
<tr>
<td>Male gender</td>
<td>17%</td>
<td>30%</td>
</tr>
<tr>
<td>Non-white race</td>
<td>23%</td>
<td>34%</td>
</tr>
<tr>
<td>Age ≥80</td>
<td>23%</td>
<td>28%</td>
</tr>
<tr>
<td>Not living at home pre-operatively</td>
<td>23%</td>
<td>45%</td>
</tr>
<tr>
<td>Not ambulatory pre-operatively</td>
<td>22%</td>
<td>32%</td>
</tr>
<tr>
<td>Current or former smoker</td>
<td>33%</td>
<td>22%</td>
</tr>
<tr>
<td>Current smokers</td>
<td>33%</td>
<td>21%</td>
</tr>
<tr>
<td>Former smokers</td>
<td>33%</td>
<td>23%</td>
</tr>
<tr>
<td>Insulin dependent diabetes</td>
<td>21%</td>
<td>31%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>27%</td>
<td>24%</td>
</tr>
<tr>
<td>COPD</td>
<td>26%</td>
<td>20%</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>24%</td>
<td>30%</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>22%</td>
<td>35%</td>
</tr>
<tr>
<td>Renal function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creatinine &lt;1.8</td>
<td>46%</td>
<td>21%</td>
</tr>
<tr>
<td>Creatinine ≥1.8</td>
<td>24%</td>
<td>39%</td>
</tr>
<tr>
<td>Dialysis</td>
<td>22%</td>
<td>52%</td>
</tr>
<tr>
<td>Tissue loss</td>
<td>13%</td>
<td>29%</td>
</tr>
<tr>
<td>Prior PVI</td>
<td>23%</td>
<td>27%</td>
</tr>
<tr>
<td>Prior LEB</td>
<td>24%</td>
<td>25%</td>
</tr>
<tr>
<td>Prior major amputation</td>
<td>23%</td>
<td>36%</td>
</tr>
<tr>
<td>Preoperative medications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-platelet</td>
<td>26%</td>
<td>24%</td>
</tr>
<tr>
<td>Statin</td>
<td>26%</td>
<td>23%</td>
</tr>
</tbody>
</table>
Univariate analysis of AFS at one-year

<table>
<thead>
<tr>
<th>Variable</th>
<th>Percent amputation or died at 1-year</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>if variable absent</td>
<td>if variable present</td>
</tr>
<tr>
<td>Procedure variables</td>
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<tr>
<td>Emergent surgery</td>
<td>24%</td>
<td>20%</td>
</tr>
<tr>
<td>Concomitant CFA</td>
<td>26%</td>
<td>11%</td>
</tr>
<tr>
<td>Number of arteries treated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>27%</td>
<td>23%</td>
</tr>
<tr>
<td>2</td>
<td>23%</td>
<td>27%</td>
</tr>
<tr>
<td>≥3</td>
<td>24%</td>
<td>25%</td>
</tr>
<tr>
<td>TASC classification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aorto-iliac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A (referent)</td>
<td>--</td>
<td>12%</td>
</tr>
<tr>
<td>B</td>
<td>12%</td>
<td>14%</td>
</tr>
<tr>
<td>C</td>
<td>12%</td>
<td>24%</td>
</tr>
<tr>
<td>D</td>
<td>12%</td>
<td>10%</td>
</tr>
<tr>
<td>Femoral-popliteal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A (referent)</td>
<td>--</td>
<td>24%</td>
</tr>
<tr>
<td>B</td>
<td>24%</td>
<td>26%</td>
</tr>
<tr>
<td>C</td>
<td>24%</td>
<td>23%</td>
</tr>
<tr>
<td>D</td>
<td>24%</td>
<td>18%</td>
</tr>
<tr>
<td>Tibial-peroneal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A (referent)</td>
<td>--</td>
<td>23%</td>
</tr>
<tr>
<td>B</td>
<td>23%</td>
<td>60%</td>
</tr>
<tr>
<td>C</td>
<td>23%</td>
<td>32%</td>
</tr>
<tr>
<td>D</td>
<td>23%</td>
<td>43%</td>
</tr>
</tbody>
</table>
Overall Survival

82%
Multivariate cox proportional hazards model used to predict OS at 1-year

<table>
<thead>
<tr>
<th>Preoperative Characteristic</th>
<th>Hazard ratio</th>
<th>95% confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dialysis Dependence</td>
<td>3.72</td>
<td>2.77-4.98</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Age &gt;80</td>
<td>2.18</td>
<td>1.68-2.82</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Not living at home preoperatively</td>
<td>1.94</td>
<td>1.36-2.75</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Creatinine &gt;1.8</td>
<td>1.89</td>
<td>1.29-2.78</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>1.69</td>
<td>1.31-2.18</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Chronic beta blockers</td>
<td>1.40</td>
<td>1.03-1.89</td>
<td>.03</td>
</tr>
<tr>
<td>Independent ambulation preoperatively</td>
<td>0.72</td>
<td>0.55-0.93</td>
<td>.01</td>
</tr>
</tbody>
</table>
Multivariate cox proportional hazards model used to predict AFS at 1-year  

<table>
<thead>
<tr>
<th>Preoperative Characteristic</th>
<th>Hazard ratio</th>
<th>95% confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dialysis dependence</td>
<td>2.92</td>
<td>2.04-4.17</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Tissue Loss</td>
<td>1.81</td>
<td>1.22-2.70</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Not living at home preop</td>
<td>1.79</td>
<td>1.11-2.87</td>
<td>.02</td>
</tr>
<tr>
<td>Male gender</td>
<td>1.58</td>
<td>1.17-2.14</td>
<td>.01</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>1.55</td>
<td>1.20-2.00</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Age &gt;80</td>
<td>1.38</td>
<td>1.00-1.92</td>
<td>.049</td>
</tr>
<tr>
<td>Smoking (current or former)</td>
<td>0.65</td>
<td>0.47-0.88</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>
Freedom From Any Major Amputation

Days

85%
Multivariate cox proportional hazards model used to predict FFA at 1-year

<table>
<thead>
<tr>
<th>Preoperative Characteristic</th>
<th>Hazard Ratio</th>
<th>95% confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Gender</td>
<td>1.62</td>
<td>1.08-2.46</td>
<td>0.02</td>
</tr>
<tr>
<td>Non-white race</td>
<td>1.70</td>
<td>1.04-2.78</td>
<td>0.049</td>
</tr>
<tr>
<td>Current or former smoker</td>
<td>0.58</td>
<td>0.39-0.87</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Dialysis Dependence</td>
<td>3.02</td>
<td>1.94-4.70</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Tissue Loss</td>
<td>2.37</td>
<td>1.30-4.31</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Prior Major Amputation</td>
<td>1.96</td>
<td>1.16-3.32</td>
<td>0.01</td>
</tr>
</tbody>
</table>
Freedom From Percutaneous Intervention

87%
Freedom From Surgical Reintervention

92%
Conclusions

• PVI for CLI within the VSGNE resulted in survival and freedom from amputation rates of 82% and 85%

• Specific pre-procedure variables are associated with decreased AFS

• After further validation this data may assist with patient selection in this challenging patient population
Factors Associated with Femoral Artery Access-Site Hematoma Following Peripheral Vascular Intervention

Jeffrey Kalish, Thomas Carruthers, Mohammad Eslami, James McPhee, Christopher Healey, Denis Rybin, Gheorge Doros, Alik Farber

On behalf of the Vascular Study Group of New England
Introduction

• Local vascular complication = most frequent adverse outcome from femoral puncture
  – Groin hematoma
  – Pseudoaneurysm
  – Retroperitoneal hematoma
  – Vessel thrombosis
  – Arteriovenous fistula
Risk Factors

- Female gender  (Piper WD, Am Heart J 2003;145:1022-9)
- Advanced Age  (Omoigui NA, J Am Coll Cardiol 1995;26:922-30)
- Obesity  (Waksman R, Am J Cardiol 1995;75:886-9)
- Anticoagulants  (Waksman R, Am J Cardiol 1995;75:886-9)
- Larger sheath  (Kim D, Cathet Cardiovasc Diagn 1992;25:91-7)

Incidence ~ 1% to 7%
Study Goals

- Utilize the VSGNE database to identify variables associated with groin hematoma after peripheral vascular intervention (PVI)
Definitions of Hematoma

- includes pseudoaneurysms
- **Minor** = required compression or observation
- **Moderate** = required transfusion or thrombin injection
- **Major** = required operation
Sample Selection

- 4930 PVI performed in 4159 patients
  - January 2010 to December 2012
  - Percutaneous femoral access
  - Occlusive disease (excludes aneurysms)

- Overall post-procedural groin hematoma rate after PVI was 4.7%
  - Range 0-19% across centers

- Rate of moderate/major hematoma was 0.9%
Regional Variation by Center
## Demographics

<table>
<thead>
<tr>
<th>Variable, n (%)</th>
<th>No Hematoma (N=4699)</th>
<th>Hematoma (N=231)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female Gender</td>
<td>1830 (38.9%)</td>
<td>128 (55.4%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age (yrs), Mean ± SD</td>
<td>67.5±11.4</td>
<td>70.1±11.5</td>
<td>0.001</td>
</tr>
<tr>
<td>Age &gt; 80</td>
<td>790 (16.8%)</td>
<td>55 (23.8%)</td>
<td></td>
</tr>
<tr>
<td>BMI, Mean ± SD</td>
<td>28.0±6.1</td>
<td>27.7±6.0</td>
<td>0.527</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2298 (48.9%)</td>
<td>101 (43.7%)</td>
<td>0.124</td>
</tr>
<tr>
<td>CAD</td>
<td>1522 (32.4%)</td>
<td>73 (31.6%)</td>
<td>0.803</td>
</tr>
<tr>
<td>HTN</td>
<td>4079 (86.8%)</td>
<td>200 (86.6%)</td>
<td>0.915</td>
</tr>
<tr>
<td>COPD</td>
<td>962 (20.5%)</td>
<td>44 (19.0%)</td>
<td>0.599</td>
</tr>
<tr>
<td>Dialysis</td>
<td>387 (8.2%)</td>
<td>13 (5.6%)</td>
<td>0.156</td>
</tr>
</tbody>
</table>
## Clinical Characteristics

<table>
<thead>
<tr>
<th>Variable, n (%)</th>
<th>No Hematoma (N=4699)</th>
<th>Hematoma (N=231)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous Bypass</td>
<td>836 (17.8%)</td>
<td>39 (16.9%)</td>
<td>0.722</td>
</tr>
<tr>
<td>Previous PVI</td>
<td>1773 (37.8%)</td>
<td>74 (32.0%)</td>
<td>0.080</td>
</tr>
<tr>
<td>ASA or Plavix</td>
<td>3893 (82.9%)</td>
<td>196 (84.8%)</td>
<td>0.434</td>
</tr>
<tr>
<td>Chronic Anticoagulant</td>
<td>460 (9.8%)</td>
<td>16 (6.9%)</td>
<td>0.150</td>
</tr>
<tr>
<td>Urgent or Emergent</td>
<td>797 (17.0%)</td>
<td>44 (19.0%)</td>
<td>0.411</td>
</tr>
<tr>
<td><strong>Timing of Procedure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jan-Jun</td>
<td>2363 (50.3%)</td>
<td>99 (42.9%)</td>
<td>0.019</td>
</tr>
<tr>
<td>Jul-Dec</td>
<td>2336 (49.7%)</td>
<td>132 (57.1%)</td>
<td></td>
</tr>
</tbody>
</table>
## Procedural Characteristics

<table>
<thead>
<tr>
<th>Variable, n (%)</th>
<th>No Hematoma (N=4699)</th>
<th>Hematoma (N=231)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bilateral Femoral Access</strong></td>
<td>769 (16.4%)</td>
<td>60 (26.0%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Ultrasound Guidance</strong></td>
<td>2034 (43.3%)</td>
<td>105 (45.7%)</td>
<td>0.483</td>
</tr>
<tr>
<td><strong>Closure Device</strong></td>
<td>1874 (39.9%)</td>
<td>57 (24.8%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Protamine</strong></td>
<td>964 (20.5%)</td>
<td>51 (22.1%)</td>
<td>0.571</td>
</tr>
<tr>
<td><strong>Treated Arteries ≥ 3</strong></td>
<td>557 (11.9%)</td>
<td>33 (14.3%)</td>
<td>0.271</td>
</tr>
<tr>
<td><strong>Contrast Volume, Mean ± SD</strong></td>
<td>113 ± 68</td>
<td>130 ± 72</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Sheath Size</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 6 French</td>
<td>3695 (78.6%)</td>
<td>164 (71.0%)</td>
<td>0.006</td>
</tr>
<tr>
<td>&gt; 6 French</td>
<td>1004 (21.4%)</td>
<td>67 (29.0%)</td>
<td></td>
</tr>
</tbody>
</table>
## Perioperative Results

<table>
<thead>
<tr>
<th>Variable, n (%)</th>
<th>No Hematoma (N=4699)</th>
<th>Hematoma (N=231)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complication Requiring Admission</td>
<td>102 (2.2%)</td>
<td>43 (18.6%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean Length of Stay</td>
<td>2</td>
<td>3.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Independent Ambulation</td>
<td>1529 (85.7%)</td>
<td>68 (76.4%)</td>
<td>0.016</td>
</tr>
<tr>
<td>Discharge to Home</td>
<td>1716 (87.5%)</td>
<td>83 (81.4%)</td>
<td>0.181</td>
</tr>
<tr>
<td>Hospital Mortality</td>
<td>23 (0.5%)</td>
<td>1 (0.4%)</td>
<td>0.904</td>
</tr>
</tbody>
</table>
Ultrasound Use
Routine vs. Selective Users

- Outcomes of surgeons based on routine or selective use of ultrasound
  - 91 surgeons with ≥ 10 PVI procedures
  - Unadjusted and adjusted analyses

- 27 Routine Users (≥ 70%)

- 64 Selective Users (< 70%)
## Multivariate Logistic Regression

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt; 80</td>
<td>2.16</td>
<td>1.04-4.52</td>
<td>0.04</td>
</tr>
<tr>
<td>Female Gender</td>
<td>1.81</td>
<td>1.37-2.40</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bilateral Femoral Access</td>
<td>1.61</td>
<td>1.16-2.24</td>
<td>0.005</td>
</tr>
<tr>
<td>Sheath Size &gt; 6 French</td>
<td>1.61</td>
<td>1.18-2.22</td>
<td>0.003</td>
</tr>
<tr>
<td>Closure Device</td>
<td>0.48</td>
<td>0.35-0.66</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Routine Ultrasound (≥ 70%)</td>
<td>0.70</td>
<td>0.52-0.95</td>
<td>0.02</td>
</tr>
<tr>
<td>Timing (Jan-Jun)</td>
<td>0.71</td>
<td>0.54-0.93</td>
<td>&lt;0.02</td>
</tr>
</tbody>
</table>
Limitations

1. Observational data from prospectively collected database

2. No standard method of hematoma identification (e.g. physical exam, duplex, CT scan)

3. In-hospital hematomas only (lower than 30-day rates)
   - Predictors presumed to be similar for hematomas after discharge
Conclusions

• Many important risk factors that predict hematoma formation after femoral arterial access are not modifiable.

• Appropriate use of smaller sheaths and closure devices, as well as routine ultrasound guidance, may potentially protect against hematoma formation.

• Quality improvement opportunities exist to decrease patient morbidity and hospital resource utilization following PVI.
Vascular Study Group of New England

Perioperative Beta Blockers

Jens Eldrup-Jorgensen, MD
November 7, 2013
VSGNE
Betablockers

Mechanism of action – decrease HR and contractility thereby reducing myocardial demand

Also anti-inflammatory, stabilize plaque, inhibit renin, and reduce tachyarrhythmias
VSGNE
Betablockers

3 receptor types

Non selective agents – propranolol and labetolol

Selective agents – metoprolol and bisoprolol
Beta blockers

**Beta blockers – Early Results**

- Mangano – NEJM 96
  - 200 patients undergoing noncardiac surgery
  - atenolol preop and X 1 week
  - decreased (cardiac and all cause) mortality
  - decreased nonfatal cardiac events
  - at 6 months and 2 years
Beta-Blocker Studies

“Bisoprolol reduces the perioperative incidence of death from cardiac causes and nonfatal myocardial infarction in high risk patients undergoing vascular surgery”

Beta-Blocker Studies

“Prophylactic atenolol reduces postoperative myocardial ischemia”

Wallace A et al; McSPI Research Group. Anesthesiology 1998; 88: 7-17
Beta blockers

- Poldermans – Dutch Echocardiographic Cardiac Risk Evaluation Applying Stress Evaluation (DECREASE)

Multiple studies
DECREASE II-VI
Recommendations

- **Agency for Healthcare Research and Quality (AHRQ)** – Beta blockers for intermediate and high risk patients
- **Leapfrog Group**
  Beta blockade for AAA operation
- **National Quality Forum (NQF)** – Beta blockers for high risk patients
- **Surgical Care Improvement Project (SCIP)** – Continue Beta blockers
VSGNE - 2003
Beta blocker committee

Andy Stanley
Phil Goodney
Brian Nolan
Jens Eldrup-Jorgensen –
Beta-Blocker Protocol

Metoprolol 25 mg PO BID

- Initiate two weeks prior to surgery
- Continue two weeks after surgery
Beta-Blocker Implementation

- Pre-printed prescription pad
Increases Across All Surgeons

Beta Blocker Use, by Surgeon

90% Beta Blocker Use Target

= 2003-2005
= 2006-2008
Beta Blocker Use Across Centers

<table>
<thead>
<tr>
<th>Center</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>63%</td>
</tr>
<tr>
<td>2</td>
<td>72%</td>
</tr>
<tr>
<td>3</td>
<td>76%</td>
</tr>
<tr>
<td>4</td>
<td>81%</td>
</tr>
<tr>
<td>5</td>
<td>85%</td>
</tr>
<tr>
<td>6</td>
<td>94%</td>
</tr>
</tbody>
</table>

**90% Beta Blocker Use Target**

2003-2005: 90%
2006-2008: 90%

No Change in POMI Over Time
No Change in Mortality Over Time

Beta Blocker Use In VSGNE 2003-2008

January-March 2003 12.8%

Mortality

Oct-December 2008 12.1% p=0.782
Beta blockers – Later Studies

• POBBLE – JVS 05 – No effect

• MaVS – JVS 08 – No effect at 30d & 6 mos
PeriOperative ISchemia Evaluation (POISE)

Devereaux et al Lancet 2008
– 8351 patients - RCT
  • 100mg PO metoprolol 2-4 hours pre op vs control

– Results:
  • Decreased MI, revascularization & AF
  • Increased death, stroke, hypotension & bradycardia
POISE

- Large dose (100 mg 2-4 hours preop and 200 mg po daily) contributed to bradycardia and hypotension

- Common cause of death - sepsis
Beta blockers – A plethora of data

• Hundreds of articles

• 13 Randomized Clinical Trials

• 8 Meta-analyses
Meta-analyses of Periop BB
Non-cardiac surgery

• Significant reduction in myocardial ischemia and non-fatal MI
• Results for mortality heavily influenced by POISE
• Before POISE – decreased mortality
• After POISE – increased mortality
Difficulties – Lack of Standardization

1. Timing of administration
2. Agent (selective vs non-selective)
3. Titration vs fixed dose
4. Heterogeneity of population
Beta blockers

Periop BB after non-cardiac surgery
Lindenauer et al  NEJM 2005

• Retrospective review of database
  – measuring quality and use of care
• 782,969 patients in 329 hospitals
• Benefits dependent on risk
Beta blockers

Periop BB after non-cardiac surgery
Lindenauer et al  NEJM 2005

• Beneficial if RCRI ≥ 2
• Harmful if RCRI 0 or 1
Risk Stratification

Revised cardiac risk index (RCRI)

1. High risk surgery
2. Ischemic heart disease
3. CHF
4. Cerebrovascular disease
5. Insulin dependent diabetes mellitus
6. Renal failure (Cr > 2)
### Periop BB – Lindenauer

#### Mortality – Odds Ratio

<table>
<thead>
<tr>
<th>RCRI</th>
<th>OR</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;4</td>
<td>0.57</td>
<td>Beneficial</td>
</tr>
<tr>
<td>3</td>
<td>0.71</td>
<td>Beneficial</td>
</tr>
<tr>
<td>2</td>
<td>0.90</td>
<td>Neutral</td>
</tr>
<tr>
<td>1</td>
<td>1.13</td>
<td>Possibly harmful</td>
</tr>
<tr>
<td>0</td>
<td>1.43</td>
<td>Possibly harmful</td>
</tr>
</tbody>
</table>
Conclusions

Reduced inhospital death among high risk but not low risk patients
Beta Blockers - RCRI

• London et al – JAMA 2013 – VASQIP
• Association of Perioperative B-Blockade with Mortality and Cardiovascular Morbidity Following Major Noncardiac Surgery
• 136,745 patients
• Analyzed by RCRI
• Vascular surgery
Beta Blockers - RCRI


- lower 30 d mortality if $\text{RCRI} \geq 2$
- lower inpt cardiac morbidity if $\text{RCRI} \geq 2$

- BUT NO BENEFIT IN VASCULAR SURGERY PATIENTS
Conclusions

Significant reduction in perioperative ischemia, MI, and cardiac mortality

Risk reduction more marked in high risk patients

Does not decrease risk in low risk patients and may be harmful

Debatable in intermediate risk patients

Treatment onset and choice of doses are limited

Ischemia and troponin are reduced and long term outcome improved in patients with lower heart rate
Guidelines for pre-op management:
2009 European Soc Cardiology/Eur Soc Anesth

Recommendations

Beta blocker should be titrated
Start 30 day and at least 7 day preoperatively
Bisoprolol 2.5 mg or Metoprolol 50 mg daily
  titrated to HR 60-70
Not in low risk patients
Duration of therapy unknown
2009 ACC/AHA Guidelines

Beta blocker

I. Continue BB in pts currently taking
IIa. Start titrated BB in pts with CAD or high risk (>2)
IIb. Usefulness uncertain in intermediate (1) to low risk (0)
Perioperative Mischief

• November 17, 2011 - Prominent Dutch Cardiovascular Researcher Fired for Scientific Misconduct

• Don Poldermans, a well-known researcher in cardiovascular medicine in the Netherlands, has been fired for scientific misconduct by the Erasmus Medical Center in Rotterdam.
Perioperative Mischief

-Poldermans - professor of medicine and the head of the section of perioperative cardiac care at the Erasmus Medical Center
- widely published and active in the field
  – multiple articles including large RCT’s
  – DECREASE I-VI
- member of the ESC committee for practice guidelines
- chairperson of the ESC guidelines on pre-operative cardiac risk assessment and perioperative cardiac management in non-cardiac surgery
Perioperative Mischief

- According to a statement from Erasmus Medical Center, an investigation found that Poldermans was careless in collecting the data for his research. In one study it was found that he used patient data without written permission, used fictitious data and that two reports were submitted to conferences which included knowingly unreliable data.
Perioperative Mischief: The Price of Academic Misconduct

Vineet Chopra, MD, MSc, a Kim A. Eagle, MD b

aDivision of General Internal Medicine and bDivision of Cardiovascular Medicine, University of Michigan Health System, Ann Arbor.

ABSTRACT

Recent allegations of fraud committed by one of the most prolific researchers in perioperative medicine, Don Poldermans, have left many clinicians in a state of disbelief. With over 500 peer-reviewed publications, Poldermans heavily influenced the clinical practice of perioperative beta-blockers and statins in noncardiac surgery, shaping guidelines and national policies on the use of these treatments. The effects of
Controversy

- Bouri et al. Meta-analysis of secure randomised controlled trials of B-blockade
- Eliminate DECREASE II-VI
- Conclusion - Beta Blockers increase postoperative mortality by 27%
- Includes POISE
Controversy

- POISE – Perioperative Ischemic Evaluation Trial
- Large RCT
- Decreased primary composite endpoint (CV death, MI, and cardiac arrest)
- Increased overall mortality
- Increased CVA
- Flawed dosing regimen
Conclusions of multiple meta-analyses and consensus statements –

• Beta blockers decrease postop ischemia, MI and mortality
• Increased risk reduction in high risk patients
• Beta blockers don’t decrease risk in low risk patients
• Beta blockers increase hypotension and possibly CVA
2003 VSGNE guidelines

- **Start beta blockers in all patients** undergoing AAA, CEA, and LEBPG
- **Start preoperatively**, preferably 2 weeks and continue 2 weeks postoperatively
- **Use selective agent** – metoprolol 25 mg po bid
- **Aim for 90% utilization rate**
- **No risk adjustment**
Dr J’s recommendations

• VSGNE - Discontinue recommendation for beta blockers in all patients

• VQI - Measure RCRI – record cerebrovascular (TIA/CVA) in AAA and LEBPG
App for Ipad and smart phone
Revised cardiac risk index (RCRI)

1. High risk surgery
2. Ischemic heart disease
3. CHF
4. Cerebrovascular disease
5. Insulin dependent diabetes mellitus
6. Renal failure (Cr > 2)

If RCRI ≥ 2, then start beta blocker
Dr J’s recommendations

• Continue beta blockers in patients on them
• Start beta blockers in high risk patients (RCRI≥2)

• Metoprolol 25 mg po BID
• Start 2 weeks preoperatively and continue 2 weeks postoperatively
Dr J’s recommendations

And DON’T FORGET

ASA and Statin in all patients

reduced 30 day mortality
improved 5 year survival
Institutional Differences in Carotid Artery Duplex Ultrasound Diagnostic Criteria Result in Significant Variability in Classification of Carotid Artery Stenoses and Likely Lead to Disparities in Care


University of Massachusetts Medical School, Worcester, MA
Harvard School of Public Health, Boston, MA
Introduction

- Carotid endarterectomy (CEA) is a proven treatment for stroke prevention in patients with symptomatic and asymptomatic carotid artery stenosis.

- SVS Guidelines*: carotid duplex ultrasound is the most definitive imaging modality for carotid artery disease.

Introduction

- Despite the publication of five multispecialty guideline documents* over the last decade, none have included standardized criteria to interpret carotid duplex ultrasounds.

- Intersocietal Accreditation Commission (IAC), approval process for vascular laboratories does not incorporate any evaluation of the carotid duplex criteria.

Brott et al. Stroke, 2011.
Introduction

• Each vascular laboratory, regardless of IAC accreditation status, develops its own duplex diagnostic criteria for the evaluation of carotid stenosis.
Hypothesis

- We hypothesize that variability of these diagnostic criteria causes significant variation in stenosis classification, likely impacting the number of revascularizations and the subsequent costs.
Methods

- Retrospective review of all consecutive carotid duplex scans performed at the University of Massachusetts vascular laboratories from 2008-2012.
Methods

- Patient demographics including:
  - Gender
  - Age
  - ICD-9-CM Diagnosis Code
  - Peak systolic velocity (PSV)
  - End diastolic velocity (EDV)
  - Internal carotid artery to common carotid artery (ICA:CCA) ratio
Methods

- For any patient with multiple scans, the scan with the greatest PSV was selected.

- Arteries with PSV of 0 were considered to be occluded.
Methods

- Each carotid artery was classified as symptomatic or asymptomatic based upon *ICD-9-CM* diagnosis code.*

- Scans missing *ICD-9-CM* code were excluded from analysis.

---

*ICD-9-CM*

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>342</td>
<td>Stroke, Hemiplegia, Hemiparesis</td>
</tr>
<tr>
<td>344</td>
<td>Stroke, other paralytic syndromes</td>
</tr>
<tr>
<td>362.3</td>
<td>Amaurosis Fugax, Retinal artery occlusion</td>
</tr>
<tr>
<td>362.34</td>
<td>Transient Monocular Blindness</td>
</tr>
<tr>
<td>362.84</td>
<td>Amaurosis Fugax, Retinal Ischemia</td>
</tr>
<tr>
<td>433.11</td>
<td>Carotid Stenosis or Occlusion, symptomatic</td>
</tr>
<tr>
<td>434.91</td>
<td>CVA, NOS</td>
</tr>
<tr>
<td>435</td>
<td>Transient Ischemic Attacks, TIA</td>
</tr>
<tr>
<td>435.8</td>
<td>TIA, other</td>
</tr>
<tr>
<td>435.9</td>
<td>TIA, unspecified</td>
</tr>
<tr>
<td>781.4</td>
<td>TIA, Transient Limb Paralysis</td>
</tr>
<tr>
<td>784.3</td>
<td>Aphasia</td>
</tr>
<tr>
<td>784.5</td>
<td>Dysarthria/Dysphasia/Slurred Speech</td>
</tr>
</tbody>
</table>

Methods—Multicenter Analysis

- Ten New England vascular laboratories, from ten distinct institutions, provided the carotid duplex ultrasound criteria that they use to classify degree of carotid artery stenosis.

- Applied each of these ten criteria to the UMass cohort to calculate the theoretical stenosis of each carotid artery as it would have been derived at each of the ten institutions.
<table>
<thead>
<tr>
<th>Site</th>
<th>Annual Number of Studies</th>
<th>Dept. Directing Vascular Lab</th>
<th>Carotid Duplex Diagnostic Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>&lt;50%</td>
</tr>
<tr>
<td>A**</td>
<td>4400</td>
<td>Vascular Surgery</td>
<td>PSV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EDV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ICA:CCA</td>
</tr>
<tr>
<td>B**</td>
<td>1964</td>
<td>Cardiology</td>
<td>PSV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EDV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ICA:CCA</td>
</tr>
</tbody>
</table>

**IAC Vascular Testing Accredited Laboratories
PSV, peak systolic velocity; EDV, end diastolic velocity; ICA:CCA, internal carotid artery to common carotid artery ratio.
Methods—Multicenter Analysis

- Calculated the total number of carotid arteries classified at each institution into the following clinically relevant treatment thresholds:
  - 70-99% Asymptomatic stenosis
  - 80-99% Asymptomatic stenosis
  - 50-99% Symptomatic stenosis
Cost Analysis

- The theoretical cost to payers for performing carotid revascularization procedures at each potential treatment threshold, as a function of institution, was determined using the 2011 average Medicare Part A reimbursement for CEA: $11,802.21
<table>
<thead>
<tr>
<th></th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Patients</td>
<td>10,614</td>
</tr>
<tr>
<td>Total Exams</td>
<td>15,534</td>
</tr>
<tr>
<td>Total Carotid Arteries</td>
<td>31,025</td>
</tr>
<tr>
<td>Mean Age</td>
<td>67.9 (STD 12.8)</td>
</tr>
<tr>
<td>Male Sex</td>
<td>5,771 (53.3)</td>
</tr>
<tr>
<td>Symptomatic Disease</td>
<td>2,488 (23.0)</td>
</tr>
</tbody>
</table>
*Site E does not utilize specific criteria for characterization of ≥70% stenosis
11.8-Fold Difference

*Site E does not utilize specific criteria for characterization of ≥70% stenosis
5.5-Fold Difference

*Site E does not utilize specific criteria for characterization of ≥70% stenosis
5.0-Fold Difference

*Site E does not utilize specific criteria for characterization of ≥70% stenosis
*Site E does not utilize specific criteria for characterization of ≥70% stenosis
Discussion

- There is marked variation in the classification of carotid stenosis for all three clinically relevant thresholds.
- IAC accreditation does not appear to have any impact upon the hemodynamic criteria selected by an institution’s vascular laboratory.
- The theoretical impact of this variation is as high as 11-fold between institutions.
- Using CEA DRG as a proxy for costs to payers, we saw variation ranges up to $24 million.
Discussion

- Patients are likely to receive dramatically different treatment recommendations as a direct function of which vascular laboratory performs their carotid duplex scan.

- In a health care environment where cost effectiveness, quality, and value are being heavily scrutinized, reduction in this variation represents an actionable item warranting further study.
Conclusion

- Standardization of carotid duplex ultrasound criteria is a longstanding substantial unmet need that will help to standardize the care of patients with carotid artery occlusive disease and may assist to control health care costs.
VSGNE Implications

- Wide variability in carotid duplex ultrasound criteria utilized at 10 major New England academic institutions
  - Including IAC and non-IAC accredited laboratories
<table>
<thead>
<tr>
<th>Institution</th>
<th>Carotid Duplex Diagnostic Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Site</td>
</tr>
<tr>
<td>A**</td>
<td>Vascular Surgery</td>
</tr>
<tr>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>I**</td>
<td>Vascular Surgery &amp; Cardiology</td>
</tr>
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</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>J**</td>
<td>Vascular Surgery</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**IAC Vascular Testing Accredited Laboratories
PSV, peak systolic velocity; EDV, end diastolic velocity; ICA:CCA, internal carotid artery to common carotid artery ratio.
VSGNE Proposal

- Development of standardized criteria for the characterization of carotid stenosis amongst VSGNE institutions

- National VQI Proposal to better understand carotid ultrasound variation and to correlate PSV, EDV, and ICA:CCA ratios with reported stenoses.
Clinical Topic: Hemodialysis Access

- **Summary of VSGNE data** – Jack Cronenwett

- **Presentation of cases with audience participation**

  - **Andy Schanzer, MD, Moderator;**
  - **Discussants:**
    - Matt Menard, MD, Alik Farber, MD, Francesco Aiello, MD
# Hemodialysis Access in VSGNE and VQI

<p>|                                      | A-V Fistula |  | A-V Graft |  |
|--------------------------------------|-------------|  |-----------|  |
|                                      | VSGNE       | VQI | VSGNE     | VQI |
| Female                               | 41%         | 41% | 57%       | 55% |
| Diabetes                             | 56%         | 61% | 51%       | 59% |
| On Dialysis Already                  | 50%         | 59% | 77%       | 80% |
| Prior Ipsilateral Access             | 30%         | 31% | 50%       | 54% |
| Prior Contralateral Access           | 31%         | 33% | 51%       | 53% |
| Pre-procedure Arterial Duplex        | 31%         | 29% | 23%       | 33% |
| Pre-procedure Vein Map               | 92%         | 82% | 84%       | 75% |
| Outpatient Procedure                 | 85%         | 81% | 78%       | 75% |
| General Anesthesia                   | 47%         | 47% | 58%       | 67% |</p>
<table>
<thead>
<tr>
<th>Access Location in VSGNE and VQI</th>
<th>A-V Fistula</th>
<th>A-V Graft</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VSGNE</td>
<td>VQI</td>
</tr>
<tr>
<td>Arterial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radial</td>
<td>32%</td>
<td>28%</td>
</tr>
<tr>
<td>Brachial</td>
<td>67%</td>
<td>71%</td>
</tr>
<tr>
<td>Other</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Venous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forearm</td>
<td>33%</td>
<td>31%</td>
</tr>
<tr>
<td>Antecubital</td>
<td>32%</td>
<td>34%</td>
</tr>
<tr>
<td>Upper Arm</td>
<td>30%</td>
<td>31%</td>
</tr>
<tr>
<td>Axillary</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Other</td>
<td>4%</td>
<td>3%</td>
</tr>
</tbody>
</table>
Basilic Vein Transposition in VSGNE and VQI

<table>
<thead>
<tr>
<th></th>
<th>VSGNE</th>
<th>VQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of all AVF</td>
<td>18%</td>
<td>22%</td>
</tr>
<tr>
<td>Two stage</td>
<td>14%</td>
<td>36%</td>
</tr>
</tbody>
</table>
Percentage of All Access Performed as A-V Fistula by VQI Region

VSGNE
Vascular Access Program

Goal:
To provide a comprehensive, organized, and consistent approach to all patients in need of hemodialysis vascular access that meets the highest standard of quality.
Vascular Access Long Term Follow Up

- Uncomplicated Functioning AV Access
  - Clinical Exam with Duplex Evaluation of the Access
    - 3 months
  - Impaired AV Access
    - Within 1 Week

- AV Access s/p Thrombectomy
  - 1 month

- AV Access s/p Angioplasty
  - 3 months

Functioning AV Access

- Clinical Exam
  - 0.6 months

- Fistulagram
  - Dialysis Access Liaison:
    - Kathleen Korenda, NP, MBA
    - PHONE: 508-612-3325, EMAIL: korenda@umassh.org
Strategic Planning for a Comprehensive Vascular Access Program

Nephrology Grand Rounds Presentation
Outreach Letter to Surrounding Nephrologists
Dinner Meeting in Springfield with Pioneer Valley Nephrology

New AV Fistula
New AV Graft
Open Revision AV access
DRIL
Fistulagram
Percutaneous Thrombectomy
Tunnelled Catheter

<table>
<thead>
<tr>
<th>Year</th>
<th>New AV Fistula</th>
<th>New AV Graft</th>
<th>Open Revision AV access</th>
<th>DRIL</th>
<th>Fistulagram</th>
<th>Percutaneous Thrombectomy</th>
<th>Tunnelled Catheter</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>2005</td>
<td>57</td>
<td>34</td>
<td>66</td>
<td>0</td>
<td>55</td>
<td>0</td>
<td>46</td>
<td>258</td>
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<tr>
<td>2006</td>
<td>48</td>
<td>25</td>
<td>76</td>
<td>5</td>
<td>73</td>
<td>0</td>
<td>70</td>
<td>297</td>
</tr>
<tr>
<td>2007</td>
<td>80</td>
<td>10</td>
<td>52</td>
<td>0</td>
<td>88</td>
<td>28</td>
<td>96</td>
<td>354</td>
</tr>
<tr>
<td>2008</td>
<td>77</td>
<td>31</td>
<td>40</td>
<td>3</td>
<td>138</td>
<td>31</td>
<td>140</td>
<td>460</td>
</tr>
<tr>
<td>2009</td>
<td>109</td>
<td>36</td>
<td>42</td>
<td>4</td>
<td>205</td>
<td>56</td>
<td>187</td>
<td>639</td>
</tr>
<tr>
<td>2010</td>
<td>137</td>
<td>62</td>
<td>40</td>
<td>8</td>
<td>347</td>
<td>70</td>
<td>254</td>
<td>918</td>
</tr>
</tbody>
</table>
ORDERING PHYSICIAN: MENARD, MATTHEW
DESCRIPTION: Duplex examination of the Venous vasculature with diameter measurements.

<table>
<thead>
<tr>
<th></th>
<th>RIGHT MM</th>
<th>LEFT MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEPHALIC PROXIMAL UPPERARM</td>
<td>7.5</td>
<td>5.2</td>
</tr>
<tr>
<td>CEPHALIC MID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIFURCATES</td>
<td>4.7 &amp; 5.2</td>
<td>5.2</td>
</tr>
<tr>
<td>CEPHALIC DISTAL</td>
<td>4.9</td>
<td>5.5</td>
</tr>
<tr>
<td>CEPHALIC PROX FOREARM</td>
<td>5.2</td>
<td>5.6</td>
</tr>
<tr>
<td>MID</td>
<td>4.2</td>
<td>4.7</td>
</tr>
<tr>
<td>DIST ( WRIST)</td>
<td>3.8</td>
<td>4.3</td>
</tr>
<tr>
<td>BASILIC PROXIMAL UPPERARM</td>
<td>6.2</td>
<td>6.1</td>
</tr>
<tr>
<td>BASILIC MID</td>
<td>4.7</td>
<td>6.4</td>
</tr>
<tr>
<td>BASILIC DISTAL</td>
<td>5.5</td>
<td>7.4</td>
</tr>
<tr>
<td>BASILIC PROXIMAL FOREARM</td>
<td>3.2</td>
<td>2.7</td>
</tr>
<tr>
<td>MID</td>
<td>2.3</td>
<td>3.5</td>
</tr>
<tr>
<td>DIST</td>
<td>2.4</td>
<td>2.7</td>
</tr>
</tbody>
</table>

CONCLUSION:
1. THE CEPHALIC AND BASILIC VEINS APPEARED PATENT AND CONTINUOUS BILATERAL MEASUREMENTS NOTED ABOVE.
2. NORMAL ARTERIAL FLOW DEMONSTRATED TO THE UPPER EXTREMITY AT REST.
3. NO EVIDENCE OF DEEP OR SUPERFICIAL VEIN THROMBOSIS IN THE RIGHT UE, HOWEVER
4. THERE IS EVIDENCE OF CHRONIC DEEP VEIN THROMBOSIS IN THE LEFT UE INVOLVING PROXIMAL JUGULAR AND PROXIMAL SUBCLAVIAN VEINS.( POSSIBLE STRICTURA DUE TO PREVIOUS LONG TERM PICC)
• 45 right-handed M with stage V CKD
• PMH: sarcoidosis

• Referred for PD catheter placement
Compressibility was normal in the left subclavian and left axillary veins. The Doppler response to respiratory variation and augmentation maneuvers was normal. There is no evidence of deep vein thrombosis in the above mentioned veins.

The vein mapping measurements taken in centimeters are as follows:

LEFT

Radial artery
  wrist .19 x .20
  mid forearm .18 x .19

Basilic upper arm with tourniquet
  proximal .35 x .34
  mid .19 x .24
  distal .18 x .17 branch
  ACF .09 x .10

Cephalic upper arm with tourniquet
  proximal .12 x .15
  mid .13 x .12
  distal superficial thrombus
HPI

- 79yo female with “a lot of problems with dialysis access” over a 4 year course.
  - Presents to Vascular Surgery for “new” access
    - Multiple bilateral IJ Tunneled catheters, IUE PICC and AVF’s
  - RUE brachial-axillary graft ‘11
PAST MEDICAL HISTORY

• PHMx:
  – Breast Cancer s/p radiation to Left chest
  – Left Frozen Shoulder
  – COPD
  – Anemia
  – CHF
  – Crohn’s Disease
  – CAD
  – HTN
  – Hypothyroidism
  – DM

• PSHx:
  – RUE AVF?
  – LUE AVF?
  – Subtotal colectomy
    • Ileostomy
  – Left breast lumpectomy
  – Sinus Surgery
DIALYSIS DRAMA

• Access History
  – 1/2009-2011: RUE fistula creations (Left arm scar??)
  – 11/2011: Intervention for thrombosed RUE brachial-axillary AVG
  – 6/2012: Acute thrombus of Left Subclavian vein (PICC)
  – 1/2013: Central venous angioplasty
  – 5/2013: Intervention for thrombosed AVG
  – 5/2013: Right IJ…Left IJ…Right femoral Tunneled catheter
**PREOPERATIVE WORK-UP**

- **Vein Mapping:**
  - RUE: Basilic and cephalic vein not visualized
  - LUE: Basilic vein 0.14-0.24cm. Cephalic not visualized

- **Physical Exam:**
  - Palpable radial and ulnar pulses.
  - Positive Allen test
OPERATIVE COURSE

• 6/2013: LUE Hybrid brachial axillary graft
  • Central Venogram with Subclavian/Innominate Stenosis
  • Angioplasty of Subclavian/Innominate vein
**ACCESS COURSE**

- **6/2013:** Loss of Radial Pulse and Signal in OR
  - Band procedure with return of signal and maintained thrill

- **8/2013:** Poorly functioning LUE AVG
  - High resistance
  - Fistulogram performed
OPERATIVE COURSE

• 6/2013: Loss of Radial Pulse and Signal
  • Band procedure with return of signal and maintained thrill

• 8/2013: Poorly functioning LUE AVG
  • High resistance → Band too tight

• 8/2013: Removal of band
  • Biphasic Radial and ulnar signal

Successful HD
ACCESS COURSE

• 9/2013: Significant hand pain and numbness with HD and present to a lesser degree at rest.
  – Slightly decreased grip strength
  – Weak monophasic Radial and Ulnar signal

• Hemodialysis Access scan:
  – No obvious lesion within AVG
  – Radial and Ulnar artery with antegrade flow
OPERATIVE COURSE

• 9/2013: LUE angiogram for Steal Syndrome
  – Angioplasty of Subclavian artery
  – Biphasic Radial and Ulnar signals

• Successful HD without symptoms of Steal
59 yo man with ESRD and right arm swelling

Alik Farber, MD
HPI

- On dialysis via right upper arm brachio-basilic AVF placed 1 year prior
- ESRD for 4 years: multiple catheters and left arm fistulas in Haiti
- Developed right arm swelling
- Fistula has been functioning well during dialysis
PMHx

- PMHx
  - HTN
  - Hyperlipidemia
  - Type 2 Diabetes
  - CHF - EF 24%
  - PE on Coumadin

- Allergic to Vancomycin
- No tobacco, no EtOH
- Meds
  - Coumadin, ASA, Coreg, Norvasc, Losartan, Iron, Aranesp, Nephrocaps, Protonix, Calcium Acetate
Exam

- Right upper extremity non-pitting edema
- Palpable right radial pulse
- Sensation and motor intact
- Palpable thrill over AVF
- No skin lesions
Fistulagram
Central Venogram
Central Venogram
• Intraclavicular Right axillary vein- Left axillary vein bypass

• Ringed PTFE graft

• Better thrill in AVF immediately postoperatively

• Arm edema resolved over 3 days
Subsequent Course

- Patient presented 6 months later with low flows during dialysis
Fistulagram

- Bypass could not be cannulated from fistula
- Subclavian vein occlusion crossed and balloon angioplasty (with 8 mm and 10 mm high-pressure balloons) performed
- Angioplasty of juxta-anastamotic AVF stenosis (5 mm balloon) performed
VSGNE Quality Committee Presentation

- 30 day Follow-up LEB pilot – Alik Farber
- Smoking cessation – Phil Goodney, Emily Spangler
- CEA LOS COPI Report – Karen Homa
- Chlorhexidine usage update – Karen Homa
Pilot 30 Day Follow-up after LEB
SSI post LEB Quality Probject

- Change the current definition of wound infection to one used by the CDC and NSQIP
Create a **30 day follow up** and specifically record: presence of SSI, ... readmission, and ABI

- Positive SSI results that are noted before 30 days will be recorded. However, **negative** SSI results will be recorded only after 30 days.

- Data will be based on office visits alone (no phone calls at this time)
SSI post LEB QP

- 9 centers (from Quality Committee) agreed to participate in this pilot (QC Centers)
- Dynamic content was created for participating sites
- Other sites were invited to participate (Non-QC Centers)
SSI post LEB QP

- 273 procedures between July 1, 2013 to October 28, 2013
- 255 procedures in July, August and September
  - October procedures excluded
  - 20 centers with 1 to 26 procedures
  - 131 procedures from 8 original Quality Committee (QC centers)
Completion of 30 day follow-up for SSI

- 68 patients had an infection or follow-up ≥ 30 days
  - All centers: $\frac{68}{255} = 26\%$ completion rate
  - QC centers: $\frac{51}{131} = 39\%$
  - Non-QC centers: $\frac{17}{124} = 14\%$
    - (assumption that centers started on July 1st)

- 60 patients had no infection documented but follow-up was < 30 days (10 to 29 days from post procedure)
  - $\frac{60}{255} = 24\%$
  - These patients did not have a follow-up to document readmission
    - unsure why this follow-up was done before 30 days

- 127 patients had no infection documented and had no follow-up
SSI Rates

• All centers
  – 50 patients had no infection = 74%
  – 14 patients had superficial infection = 21%
  – 3 patients had deep infection = 4.4%
  – 1 missing (no data entered for SSI)

• VSGNE original
  – 38 patients had no infection = 75%
  – 10 patients had superficial infection = 20%
  – 2 patients had deep infection = 4.0%
  – 1 missing (no data entered for SSI)

• Other centers
  – 12 patients had no infection = 71%
  – 4 patients had superficial infection = 24%
  – 1 patient had deep infection = 5.9%

These 68 patients did not have wound infection at discharge.
Readmission Rates

• All centers
  – 42 patients had no readmission = 62%
  – 15 patients had procedure related readmission = 22%
  – 11 patients had procedure unrelated readmission = 16%

• QC centers
  – 31 patients had no readmission = 60%
  – 10 patients had procedure related readmission = 20%
  – 10 patients had procedure unrelated readmission = 20%

• Non-QC centers
  – 11 patients had no readmission = 65%
  – 5 patients had procedure related readmission = 29%
  – 1 patient had procedure unrelated readmission = 6.0%
Summary and Conclusions

- An attempt was made to capture 30 day outcomes after LEB (wound infection and readmission).
- Completion of follow up for 30 day outcome for wound infection or readmission was only 26% (was 39% for QC centers).
- 74% of patients were SSI-free.
- Of the 68 evaluable patients who were noted to have a 21% SSI rate none had documented wound infection at discharge.
- 62% of patients avoided readmission.
Smoking Cessation Quality Improvement Proposal

Philip Goodney
Alik Farber
Emily Spangler
Background

• Smoking is detrimental to our patients and our results

• Quitting is hard but important
Background

- Smoking is detrimental to our patients and our results
- Quitting is hard but important
Background

• Smoking is detrimental to our patients and our results
• Quitting is hard but important
• Vascular Surgery may be the “teachable moment”
Background

• Smoking is detrimental to our patients and our results
• Quitting is hard but important
• Vascular Surgery may be the “teachable moment”
Background

• Smoking is detrimental to our patients and our results
• Quitting is hard but important
• Vascular Surgery may be the “teachable moment”
• Some centers are more successful in achieving smoking cessation than others, and efforts vary
Fig 3. Treatment center level comparisons are shown using observed/expected and analysis of means. The treatment center number is arbitrarily assigned in this graph. $P < .05$ for values outside of upper and lower limits. VSGNE, Vascular Study Group of New England.
A QI Intervention was born...

Variation in smoking cessation implementation and success across centers + Collaboration with an expert who has a better, uniform approach = Potential for an effective quality improvement initiative
VSGNE Smoking Cessation QI Intervention Proposal

• QI intervention
  – Proposed Kick Off Dec 1, 2013
• Developed within the VSNGE Quality Committee

• Simple

• Essentially Free

• Requires no infrastructure other than a fax machine
Plan for QI Intervention

• Physician enters room
• Physician delivers card-based discussion
• Obtain permission from patient to have the quit-line call them.
  – (Patients must sign forms in CT, MA, and RI; permission alone OK in NH/VT/ME)
  – Offer NRT using 3x5 card
### Step 1: Offer

Offer “very brief advice” on smoking cessation ([http://www.ncsct-training.co.uk/player/play/VBA](http://www.ncsct-training.co.uk/player/play/VBA))

**Ask:**

“Are you still smoking?” (if yes, or quit <30 days ago, then proceed as below)

**Advise:**

“Smoking increases the chance that you will have poor results from vascular procedures. Quitting smoking will greatly improve your results.”

**Act:**

“It is difficult to quit smoking, but I want to help you quit. My approach is two-fold:

1. First, we are going to connect you to a free, telephone-based program, called 1-800-QUITNOW, that will help you quit. They will contact you by phone to help you do this.
2. Second, I’ll write you a prescription for nicotine replacement therapy, which will consist of a patch for daily use, and gum or lozenges for breakthrough cravings.

### Step 2: Report

At the end of the surgeon’s clinic visit, office staff will assist interested patients in completing a pre-printed fax referral form (in MA, CT, and RI the patient must sign the form) and fax completed forms to the quit line. The quit line will contact the patient and assist in smoking cessation.
Prescribing Nicotine Replacement Flowsheet

Nicotine Patch

- Smokes ≥ 10 cigarettes/day?
  - yes
    - Begin with 21 mg nicotine patch
      Taper use off over 4-6 weeks
  - no
    - Begin with 14 mg nicotine patch
      Taper use off over 4-6 weeks

PRN Nicotine

Nicotine Gum
- 2 mg gum q1hr prn
  - no
    - Smokes ≥ 25 cigarettes/day?
      - yes
        - 4 mg gum q1hr prn
      - no
        - 2 mg lozenge q1-2hr prn

Nicotine Lozenge
- Smokes 1st cigarette <30 minutes after waking?
  - yes
    - 4 mg lozenge q1-2hr prn
  - no
    - 2 mg lozenge q1-2hr prn

See PCP for Other Pharmacologic Assistance
Bupropion, Varenicline, etc.
<table>
<thead>
<tr>
<th>Drug Generic (Brand)</th>
<th>Dose</th>
<th>Duration</th>
<th>Common Adverse Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bupropion sustained release (Wellbutrin SR, zyban)</td>
<td>150 mg daily for 3 days, then 150 mg BID Start 1 week before quit date</td>
<td>3-6 months</td>
<td>Insomnia, vivid or abnormal dreams, or dry mouth</td>
</tr>
<tr>
<td>Varenicline (Chantix)</td>
<td>0.5 mg daily for 3 days, then 0.5 mg BID for 4 days, then 1 mg BID Start 1 week before quit date</td>
<td>3-6 months</td>
<td>Nausea, insomnia or vivid or abnormal dreams</td>
</tr>
<tr>
<td>Nicotine Patch 21, 14, or 7 mg (Nicotrol, Nicoderm CQ) *Available OTC</td>
<td>Apply 1 new patch daily If ≥10 cigarettes/day: 21 mg daily If &lt;10 cigarettes/day: 14 mg daily Taper to lower dose after 4-6 weeks</td>
<td>≥2-3 months</td>
<td>Skin irritation, insomnia</td>
</tr>
<tr>
<td>Nicotine Gum 2 or 4 mg (Nicorette) *Available OTC</td>
<td>1 piece every hour prn If ≥25 cigarettes/day: 4 mg piece If &lt;25 cigarettes/day: 2 mg piece Use ≤24 pieces/day total</td>
<td>≥3 months</td>
<td>Mouth irritation, jaw soreness, or heartburn</td>
</tr>
<tr>
<td>Nicotine Lozenge 2 or 4 mg (Commit) *Available OTC</td>
<td>1 piece every 1-2 hours prn If 1st cigarette ≥30 min after waking: 2mg If 1st cigarette &lt;30 min after waking: 4mg</td>
<td>3-6 months</td>
<td>Hiccups or heartburn</td>
</tr>
</tbody>
</table>
Plan for QI Intervention

• At the end of clinic, support personnel will fax the referral forms.
• The quit line will then contact the patient according to each of the individual state-level quit lines
What does the quit line do?

- Assigns a coach
- Provides tips and techniques
- Establishes a quit date, provides printed materials and local referral information
- Schedules a follow up call to check in on quit-date success.
- There are slight state-to-state differences in quit line protocols.
Outcomes Assessment

• Quit-line based
  • How often were they successful
  • How commonly did patients quit

• Survey of physicians
  • Do they think the process is integrated smoothly into their practice
  • Are the physicians actually implementing this process
Executive Summary

• What you need to do:
  – Offer organized smoking cessation counseling and NRT in your clinic using the state-level fax referral forms we will provide.
  – Send in the fax forms at the end of your clinic
• That’s it!! Everything else is done by the quit line!!!
Executive Summary

• We hope the VSGNE will endorse this region-wide QI initiative.

• We welcome any interested parties willing to support this effort on our committee.
Acknowledgement

• Thank you to Dr. Rigotti
• The VSGNE Quality Committee
• SVS/M2S staff

Questions???
Elective Carotid Endarterectomy
LOS COPI report

Karen Homa, Ph.D.
Quality Director
Reducing Length of Stay

• Due to the increasing importance of cost control, reducing unnecessary LOS has become a priority at all hospitals
Reducing LOS

• 32% of the patients stay longer than 1 day after elective Carotid Endarterectomy
  – Exclude patients with procedures
    • on the weekend,
    • death within 1 day after procedure,
    • prior ipsilateral CEA, and concomitant CABG, proximal endovascular and other arterial procedure.

• Area for improvement
  – Center Opportunity Profile for Improvement (COPI)
Percent of Patients with Length of Stay > 1 day (post-procedure to discharge) after Elective Carotid Endarterectomy
Expected and Observed (adjusted for risk factors listed in COPI report)

LOS greater than 1 day after CEA varies across VQI centers from 0% to 100%.
Elective Carotid Endarterectomy

• Factors associated with LOS > 1 day post procedure
  – Patient characteristics
  – Procedure details
  – Post-op complications
  – Annual surgeon volume

Possible target for better discharge planning

Modifiable factors – possible areas to change to improve an outcome
<table>
<thead>
<tr>
<th></th>
<th>Your center</th>
<th>VQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of procedures</td>
<td>34</td>
<td>12,845</td>
</tr>
<tr>
<td><strong>Length of stay (days)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>2.2</td>
<td>1.9</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>2.7</td>
<td>6.0</td>
</tr>
<tr>
<td>Median</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>% LOS &gt; 1 day</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>32%</td>
<td></td>
</tr>
<tr>
<td>Expected</td>
<td>41%</td>
<td></td>
</tr>
<tr>
<td>Observed statistically significant from Expected (Green observed lower than expected, Red observed higher than expected)</td>
<td>not significant</td>
<td></td>
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</table>
# Your Center Opportunity Profile for Improvement (COPI)

**Legend:**
- Lowest 25th percentile
- Highest 75th percentile

## Risk factors for LOS > 1 day

<table>
<thead>
<tr>
<th>Patient Characteristics</th>
<th>Odds Ratio</th>
<th>Your center</th>
<th>VQI Overall rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Female</strong></td>
<td>1.4</td>
<td>44%</td>
<td>40%</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 60 years</td>
<td>Reference</td>
<td>44%</td>
<td>45%</td>
</tr>
<tr>
<td>70-79 years</td>
<td>1.3</td>
<td>37%</td>
<td>37%</td>
</tr>
<tr>
<td>&gt;= 80 years</td>
<td>1.9</td>
<td>19%</td>
<td>18%</td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Diabetes</td>
<td>Reference</td>
<td>70%</td>
<td>69%</td>
</tr>
<tr>
<td>Insulin Dependent Diabetes</td>
<td>1.6</td>
<td>18%</td>
<td>19%</td>
</tr>
<tr>
<td><strong>Chronic Heart Failure</strong></td>
<td>1.6</td>
<td>8%</td>
<td>9%</td>
</tr>
<tr>
<td><strong>Stress Test done</strong></td>
<td>1.3</td>
<td>16%</td>
<td>36%</td>
</tr>
<tr>
<td><strong>Pre-op Stroke</strong></td>
<td>1.7</td>
<td>27%</td>
<td>15%</td>
</tr>
</tbody>
</table>
More patients with this risk factor

Less patients with this risk factor

25%

36%

44%

60%

70%
More patients with this risk factor
Your center’s average and median LOS after isolated elective CEA, with 1 standard deviation, are shown in the table below, and compared with all centers. In addition, your center’s observed and expected percentage of patients with LOS > 1 day are shown, with a statistical calculation of whether this percentage is higher than expected based on the characteristics of patients in your center compared to all VQI centers.

<table>
<thead>
<tr>
<th>Your center</th>
<th>VQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of procedures</td>
<td>70</td>
</tr>
<tr>
<td>Length of stay (days)</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>1.6</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>1.5</td>
</tr>
<tr>
<td>Median</td>
<td>1</td>
</tr>
</tbody>
</table>

% LOS > 1 day

<table>
<thead>
<tr>
<th>Observed</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>34%</td>
<td>36%</td>
</tr>
</tbody>
</table>

Observed statistically significant from Expected (Green observed lower than expected, not significant. Red observed higher than expected.)

The line graph below show the percentage of patients with LOS > 1 day in your center over time, compared with all VQI centers, with the actual distribution of LOS in your center compared to all VQI centers.

The COPI report lists all factors that contribute to prolonged LOS after CEA along with the percent that each of these factors contributed to the total potential opportunity, presented as a percentile. Indications are also outlined for model. This shows how much each factor contributes to the total potential opportunity, presented as a percentile. This means that patient characteristics compared to a risk of prolonged LOS have significant impact on a longer LOS.

Patient characteristics are listed directly earliest in the COPI report, followed by post-operative complications.

Risk factors for LOS > 1 day

<table>
<thead>
<tr>
<th>Patient Characteristics</th>
<th>Odds Ratio</th>
<th>Your center</th>
<th>VQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>1.4</td>
<td>26%</td>
<td>40%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 60 years</td>
<td>Reference</td>
<td>70%</td>
<td>69%</td>
</tr>
<tr>
<td>70-79 years</td>
<td>1.3</td>
<td>44%</td>
<td>45%</td>
</tr>
<tr>
<td>&gt;= 80 years</td>
<td>1.9</td>
<td>31%</td>
<td>37%</td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Diabetes</td>
<td>Reference</td>
<td>70%</td>
<td>69%</td>
</tr>
<tr>
<td>Insulin Dependent Diabetes</td>
<td>1.6</td>
<td>53%</td>
<td>36%</td>
</tr>
<tr>
<td>Chronic Heart Failure</td>
<td>1.7</td>
<td>53%</td>
<td>36%</td>
</tr>
<tr>
<td>Stress Test done</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-op Stroke</td>
<td>1.3</td>
<td>77%</td>
<td>68%</td>
</tr>
</tbody>
</table>

Procedure details

<table>
<thead>
<tr>
<th>Anesthesia Type</th>
<th>General Anesthesia</th>
<th>Odds Ratio</th>
<th>Your center</th>
<th>VQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patch Type</td>
<td>Autogenous Vein</td>
<td>2.0</td>
<td>43%</td>
<td>91%</td>
</tr>
<tr>
<td>IV Med Required for Hypertension</td>
<td>0.0</td>
<td>1.7</td>
<td>36%</td>
<td></td>
</tr>
<tr>
<td>IV Med Required for Hypertension</td>
<td>2.2</td>
<td>43%</td>
<td>91%</td>
<td></td>
</tr>
</tbody>
</table>

Post-op complications

<table>
<thead>
<tr>
<th>Any Cranial Nerve Injury</th>
<th>Odds Ratio</th>
<th>Your center</th>
<th>VQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Neurologic Event</td>
<td>1.3</td>
<td>26%</td>
<td>16%</td>
</tr>
<tr>
<td>Respiratory Symptoms</td>
<td>10.9</td>
<td>25%</td>
<td>16%</td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>4.9</td>
<td>25%</td>
<td>16%</td>
</tr>
<tr>
<td>Dysrhythmia</td>
<td>9.5</td>
<td>20%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Post-op Chronic Heart Failure</td>
<td>5.3</td>
<td>14%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Return to OR - Bleeding/Other</td>
<td>6.7</td>
<td>14%</td>
<td>1.3%</td>
</tr>
</tbody>
</table>

Annualized VQI Surgeon Volume

<table>
<thead>
<tr>
<th>Procedures 20 or more</th>
<th>Odds Ratio</th>
<th>Your center</th>
<th>VQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 8</td>
<td>2.5</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>9 to 12</td>
<td>1.9</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>13 to 19</td>
<td>2.6</td>
<td>19%</td>
<td>67%</td>
</tr>
<tr>
<td>20 or more</td>
<td>2.0</td>
<td>14%</td>
<td>1.8%</td>
</tr>
</tbody>
</table>

Legend: Lowest 25th percentile, Highest 75th percentile.
Surgical Site Infection INFRA
Surgical Site Infection Project

- First national quality improvement initiative
  - Spring 2012
- **VQI workgroup:** Adam Beck, Jason Chiriano, Jack Cronenwett, Mark Davies, Alik Farber, Karen Homa, Jeff Kalish, Megan Tracci, Magdiel Trinidad, Mark Wyers
- Analyzed risk-factors associated with in-hospital SSI after infra-inguinal bypass procedures
SSI outcomes analysis

- 7,908 VQI procedures
  - 2003 to June 2012

- Univariate - Several variables associated with SSI
  - BMI: OR = 1.35
  - Skin prep: OR = 0.62 protective
    - chlorhexidine or chlorhexidine with alcohol (Chloraprep) versus Iodine
  - Tissue loss: OR = 1.38
  - Graft recipient (distal: below knee): OR = 1.3
  - Transfusion ≥ 3 units: OR = 2.7
Multivariate logistic regression model

- Ankle-Branchial Index <0.35 on procedure side was associated with higher odds of SSI (OR 1.5)
- Chlorhexidine or chlorhexidine with alcohol was associated with lower odds of SSI (thus protective; OR 0.5)
- Transfusion ≥ 3 units was associated with higher odds of SSI (OR 3.3)
- Surgery time longer than 220 minutes was associated with higher odds of SSI
  - 221 to 290 minutes OR 2.1
  - > 290 minutes OR 2.9
- Area under ROC curve = 0.707
Surgical Site Infection Rate after Lower Extremity Bypass
Observed and Expected by VQI Centers
3,615 patient procedures January 2010 to June 2012

Overall Rate Surgical Site Infection
VQI = 4.2%
AUC = 0.65

VQI Centers
adjusted for: skin preparation, ABI < 0.35, transfusion, procedure time

* Significantly higher than expected (p-value < 0.05) Chi-square test
December 2012 – centers were sent an email to share results:

<table>
<thead>
<tr>
<th>COPI</th>
<th>VQI wound infection rate</th>
<th>3.6%</th>
<th>SVS PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center Name</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your center’s number of procedures</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your center’s wound infection rate</td>
<td>28.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your center’s wound infection expected rate</td>
<td>5.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed rate vs. Expected rate</td>
<td>Rates significantly different p&lt;0.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

### Predictors of wound infection

<table>
<thead>
<tr>
<th>VQI Average</th>
<th>Chlorhexidine Skin Prep</th>
<th>Transfusion ≥ 3 units</th>
<th>Procedure time &gt; 220 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher is better</td>
<td>60%</td>
<td>5.8%</td>
<td>50%</td>
</tr>
<tr>
<td>Lower is better</td>
<td>33%</td>
<td>71%</td>
<td></td>
</tr>
</tbody>
</table>

**Your Center**

- Significantly higher infection rate than expected. Switch to Chlorhexidine. Reduce number of transfusions.

**Improvement Opportunity**

Note: This patient safety work product generated within the SVS PSO, LLC, is considered privileged and confidential.
INFRA File

• As of 8.1.2013 there have been 12,855 INFRA procedures
  – 8,293 had skin prep
    • Chlorhexidine with or without alcohol
    • Iodine with or without alcohol
    • Exclude alcohol only, chlorhexidine & iodine, and all 3 (alcohol, chlorhexidine & iodine)
  – 7,545 had procedure > 2010
126 centers

Chorhexidine usage

62% 77% 83% 89%

Number of centers contributing data per week

10 to 57 centers contributing procedures per week: Not all centers join VQI at the same time
INFRA File

- As of 8.1.2013 there have been 12,855 INFRA procedures
  - 8,293 had skin prep
    - Chlorhexidine with or without alcohol
    - Iodine with or without alcohol
    - Exclude alcohol only, chlorhexidine & iodine, and all 3
  - 7545 had procedure > 2010
  - 4779 procedures at centers that had 10 or more procedures per year (2011, 2012, & 2013)
38 centers

Chlorhexidine usage

Number of centers contributing data per week

9 to 30 centers contributing procedures per week: Not all centers join VQI at the same time
38 centers

G-chart: In-hospital SSI

38 centers

On average 28 patients do not have infection then the next patient has SSI: \( \frac{1}{29} = 3.4\% \)
38 centers: 2011 chlorhexidine usage

- Classification of centers
- Rare: <10% = rare usage
  - 3 centers
- Routine: => 80%
  - 23 centers
- Selective: Between 10% to < 80%
  - 12 centers
38 centers: Chlorhexidine usage per year

- 23 centers routinely using chlorhexidine
- Some centers increased their usage of chlorhexidine
- Some centers usage of chlorhexidine remained the same
38 centers: Chlorhexidine change of usage from 2011 to 2013

• Classification of centers

• Increase usage
  – 11 centers

• Same selective usage
  – 5 centers

• Same routine usage
  – 22 centers
  – 1 center routine usage in 2011 moved to selective usage but difference in chlorhexidine usage between 2011 to 2013 was not significant (94% to 74%; Fisher exact test p > 0.05)
38 centers: Chlorhexidine change of usage from 2011 to 2013

• Classification of centers
  • Increase usage
    – 11 centers
  • Same selective usage
    – 5 centers
  • Same routine usage
    – 22 centers
    – 1 center routine usage in 2011 moved to selective usage but difference in chlorhexidine usage between 2011 to 2013 was not significant (94% to 74%; Fisher exact test p > 0.05)
11 centers: increased usage

Chorhexidine usage

- LCL 3 sigma
- Center Line
- UCL 3 sigma
- Proportion

All centers contributing procedures: 8 to 11 centers per month

COPI report emailed
11 centers: increased usage

**G-chart: In-hospital SSI**

11 centers increased usage of chlorhexidine from 2011 to 2013 with 10 or more procedures each year

Higher is better

Number of patients between patient with SSI (%)

All centers contributing procedures: 8 to 11 centers per month
38 centers: Chlorhexidine usage per year

- Classification of chlorhexidine change of usage from 2011 to 2013
  - Increase usage
    - 16% to 93%
    - 11 centers
  - Same selective usage (46%)
    - 5 centers
  - Same routine usage (97%)
    - 22 centers
    - 1 center routine usage in 2011 moved to selective usage but difference in chlorhexidine usage between 2011 to 2013 was not significant (94% to 74%; Fisher exact test p > 0.05)

- No change in SSI 3.3%
- Increase usage 29%
- Same usage: selective 13%
- Same usage: routine 58%
- Decrease in SSI 4.7% to 1.2%
  - 3 centers reduced transfusions

SSI not stable measure over time 3.4%
Decrease in SSI from 4.7% to 1.2%

- 853 patients had 10 SSI (1.2%)
  - At the prior 4.7% rate there would have been 41 SSI
  - Prevented 31 SSI in-hospital

- Depending on the severity of the SSI cost range from $400 to $30,000
  - Longer hospital stay, readmissions, clinic and ED visits, surgery, prolong antibiotic treatment, test, home visits
  - Lost work time, reduction in quality of life

Using Predicted Long Term Mortality to Compare and Improve Patient Selection

Brian W. Nolan, MD, MS
Assistant Professor of Surgery Dartmouth Medical School
Assistant Research Professor, The Dartmouth Institute of Health Policy and Clinical Practice
By collecting and exchanging information, the group strives to continuously improve the quality, safety, effectiveness and cost of vascular healthcare.

This is how we do it

This is who we do it to
Aim: Describe a methodology for comparing patient selection and profiling risk which could be applicable across procedures.

Goals
1. Improve outcomes through more appropriate patient selection
2. Understand who will benefit from prophylactic surgery where life expectancy is part of the decision making process
Comparing Risk Adjusted Outcomes
“Leveling the Playing Field”

• Use multivariate model to identify factors which predict the outcome

• Calculate an “expected” stroke or death rate based on patient characteristics and compare “observed” rates

Stroke or Death after CEA

<table>
<thead>
<tr>
<th></th>
<th>Expected</th>
<th>Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center A</td>
<td>0.5%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Center B</td>
<td>0.8%</td>
<td>1.1%</td>
</tr>
</tbody>
</table>
COMPARING CRUDE RATES

Stroke or Death after CEA

~4x higher stroke or death rate

P=0.007

0.3%

1.1%

0.7% chance of Type I error

Technical difference

Patient selection

Center

A
N=>1000

B
N=>400
What can we tell about patient selection from expected event rates?

- Center B has a slightly higher expected event rate.
- Compared to Center A patients at Center B have more comorbidities which are associated with the stroke or death:
  - Age, symptom status, CHF, contralateral occlusion, aspirin
EXPECTED RATES AND PATIENT SELECTION

Patient selection is very similar. Right?
**EXPECTED RATES AND PATIENT SELECTION**

- Does this mean patient selection is similar between centers?
  - Based on characteristics **in the** model.
    - Likely other characteristics surgeons may use in patient selection.
  - Significant unexplained variation
    - AUC 0.75 (25% of variation not accounted for in the model)
  - May be significant center effect
    - Confounded centers having different patient demographics (clustering)
**Patient Characteristics**

CEA  
N=11,082

- **Asymptomatic status**: 60%  
- **Contralateral occlusion**: 6%  
- **Age**: 70  
- **Female**: 39%  
- **Hypertension**: 85%  
- **Any history of tobacco use**: 80%  
- **Any history of CAD**: 30%  
- **Any history of CHF**: 4.1%  
- **Any history of diabetes**: 28%  
- **IDDM**: 7.5%  
- **Any COPD**: 15%  
- **O2 dependant COPD**: 1.1%  
- **Renal insufficiency**: 5.4%  
- **No aspirin**: 10%  
- **No statin**: 26%  
- **Dialysis dependence**: 0.5%
**PATIENT CHARACTERISTICS**

**STRATIFIED BY CENTER**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic status</td>
<td>57%</td>
<td>65%</td>
<td>0.005</td>
</tr>
<tr>
<td>Contralateral occlusion</td>
<td>6.5%</td>
<td>4.3%</td>
<td>0.5</td>
</tr>
<tr>
<td>Age</td>
<td>70</td>
<td>70</td>
<td>ND</td>
</tr>
<tr>
<td>Female</td>
<td>37%</td>
<td>43%</td>
<td>0.050</td>
</tr>
<tr>
<td>Hypertension</td>
<td>87%</td>
<td>82%</td>
<td>0.018</td>
</tr>
<tr>
<td>Any history of tobacco use</td>
<td>83%</td>
<td>75%</td>
<td>0.010</td>
</tr>
<tr>
<td>Any history of CAD</td>
<td>30%</td>
<td>30%</td>
<td>ND</td>
</tr>
<tr>
<td>Any history of CHF</td>
<td>3.4%</td>
<td>5.5%</td>
<td>0.080</td>
</tr>
<tr>
<td>Any history of diabetes</td>
<td>26%</td>
<td>32%</td>
<td>0.04</td>
</tr>
<tr>
<td>IDDM</td>
<td>7.2%</td>
<td>8.1%</td>
<td>ND</td>
</tr>
<tr>
<td>Any COPD</td>
<td>17%</td>
<td>12%</td>
<td>0.027</td>
</tr>
<tr>
<td>O2 dependent COPD</td>
<td>1.1%</td>
<td>1.0%</td>
<td>ND</td>
</tr>
<tr>
<td>Renal insufficiency</td>
<td>4.8%</td>
<td>6.8%</td>
<td>0.14</td>
</tr>
<tr>
<td>No aspirin</td>
<td>6%</td>
<td>19%</td>
<td>0.001</td>
</tr>
<tr>
<td>No statin</td>
<td>23%</td>
<td>32%</td>
<td>0.001</td>
</tr>
<tr>
<td>Dialysis dependence</td>
<td>0.6%</td>
<td>0.3%</td>
<td>ND</td>
</tr>
</tbody>
</table>
Question: Given the potential loss of granular detail calculating “expected” event rates, and the potentials for error, how else might we describe patient selection?

Hypothesis: Meaningful differences in comorbidities should be reflected in **long-term survival** (particularly germane to operations where the decision making should involve life expectancy)
SURVIVAL BY CENTER

10-year survival ranges from 51 to 78%

Expected event rates range from 1.6 to 2.0%
### Long Term Mortality Risk Score

Derived in 11,318 Carotid Revascularizations

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Coef.</th>
<th>NL Coef.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt;80</td>
<td>1.109</td>
<td>5.7</td>
</tr>
<tr>
<td>Dialysis dependence</td>
<td>1.086</td>
<td>5.6</td>
</tr>
<tr>
<td>O2 dep COPD</td>
<td>1.006</td>
<td>5.2</td>
</tr>
<tr>
<td>Not on a statin</td>
<td>0.724</td>
<td>3.7</td>
</tr>
<tr>
<td>Age 70-79</td>
<td>0.662</td>
<td>3.4</td>
</tr>
<tr>
<td>Any history of CHF</td>
<td>0.519</td>
<td>2.7</td>
</tr>
<tr>
<td>Renal insufficiency</td>
<td>0.501</td>
<td>2.6</td>
</tr>
<tr>
<td>IDDM</td>
<td>0.437</td>
<td>2.3</td>
</tr>
<tr>
<td>Any history of CAD</td>
<td>0.401</td>
<td>2.1</td>
</tr>
<tr>
<td>Not on an aspirin</td>
<td>0.391</td>
<td>2.0</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>0.341</td>
<td>1.8</td>
</tr>
<tr>
<td>Preop TIA</td>
<td>0.314</td>
<td>1.6</td>
</tr>
<tr>
<td>Preop Stroke</td>
<td>0.279</td>
<td>1.4</td>
</tr>
<tr>
<td>Med dep DM</td>
<td>0.193</td>
<td>1</td>
</tr>
</tbody>
</table>
LONG TERM MORTALITY RISK SCORE
WHO HAS THE HIGHER RISK OF 5-YEAR MORTALITY?

<table>
<thead>
<tr>
<th></th>
<th>Coef.</th>
<th>NL Coef.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≥80</td>
<td>1.109</td>
<td>5.7</td>
</tr>
<tr>
<td>Dialysis dependence</td>
<td>1.086</td>
<td>5.6</td>
</tr>
<tr>
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<td><strong>Not on a statin</strong></td>
<td><strong>0.724</strong></td>
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<td>Age 70-79</td>
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<tr>
<td>Renal insufficiency</td>
<td>0.501</td>
<td>2.6</td>
</tr>
<tr>
<td><strong>IDDM</strong></td>
<td><strong>0.437</strong></td>
<td><strong>2.3</strong></td>
</tr>
<tr>
<td>Any history of CAD</td>
<td>0.401</td>
<td>2.1</td>
</tr>
<tr>
<td>Not on an aspirin</td>
<td>0.391</td>
<td>2.0</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>0.341</td>
<td>1.8</td>
</tr>
<tr>
<td>Preop TIA</td>
<td>0.314</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Preop Stroke</strong></td>
<td><strong>0.279</strong></td>
<td><strong>1.4</strong></td>
</tr>
<tr>
<td>Med dep DM</td>
<td>0.193</td>
<td>1</td>
</tr>
</tbody>
</table>

65 y.o. asx, no comorbidities, on aspirin, but **not** a statin

65 y.o. presents with a stroke, has IDDM, on aspirin and statin
**Survival after CEA by Risk Score Quartile**

<table>
<thead>
<tr>
<th>Mortality Risk Score</th>
<th>5-year Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4.0</td>
<td>93%</td>
</tr>
<tr>
<td>4.0 to 9.1</td>
<td>87%</td>
</tr>
<tr>
<td>9.2 to 11.6</td>
<td>81%</td>
</tr>
<tr>
<td>&gt;11.6</td>
<td>65%</td>
</tr>
</tbody>
</table>

P < 0.001
IDENTIFYING PATIENTS AT HIGH RISK FOR LONG TERM MORTALITY

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Median mRSC</th>
<th>% Asx</th>
<th>5-yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk, mRSC &lt;4</td>
<td>1.8</td>
<td>75%</td>
<td>93%</td>
</tr>
<tr>
<td>Intermediate risk, mRSC 4-12</td>
<td>7.2</td>
<td>67%</td>
<td>82%</td>
</tr>
<tr>
<td>High risk, mRSC &gt;12</td>
<td>13.7</td>
<td>46%</td>
<td>55%</td>
</tr>
</tbody>
</table>

~500 high risk asymptomatic patients
IDENTIFYING PATIENTS AT HIGH RISK FOR LONG TERM MORTALITY

Average annual mortality = 9%

Average annual stroke risk = 2.1%

Benefit for ~500 asymptomatic patients?
Higher predicted long term mortality associated with worse in-hospital outcomes after CEA.

**Stroke or Death Rate**

- **Low risk**
  - mrsc < 4
  - 5-yr 93%
  - 0.68%

- **Intermediate risk**
  - mrsc 4-12
  - 5-yr 82%
  - 1.02%

- **High risk**
  - mrsc >12
  - 5-yr 55%
  - 1.77%

*P=0.010*
**RELATIONSHIP BETWEEN PREDICTED LONG TERM MORTALITY AND IN-HOSPITAL OUTCOMES FOR CEA**

**Stroke or Death Rate**

- Low risk: mrsc < 4, 5-yr 93%
- Intermediate risk: mrsc 4-12, 5-yr 82%
- High risk: mrsc >12, 5-yr 55%

**Stroke rate**

- Low risk: 0.68%
- Intermediate risk: 1.02%
- High risk: 1.77%

**P-values**

- Stroke or Death Rate: P=0.010
- Stroke rate: P=0.043

**Center Effect?**

- Low risk: 0.64%
- Intermediate risk: 0.91%
- High risk: 1.49%
**Question:** Is the relationship between predicted long term mortality and in-hospital stroke or death confounded by a center effect?

*If higher volume centers had better technical outcomes leading to lower stroke or death rates, AND selected lower risk patients.*
Higher Volume Centers Select Higher Risk Patients for CEA

% at High Risk for Long Term Mortality

- < 57: 10.0%
- 57 to 84: 8.3%
- 85 to 124: 9.4%
- 125 to 199: 10.9%
- >200: 12.1%

Annualized Center Volume

P = 0.001
NO SIGNIFICANT RELATIONSHIP BETWEEN CENTER VOLUME AND IN-HOSPITAL STROKE OR DEATH AFTER CEA

Stroke or Death

<table>
<thead>
<tr>
<th>Annualized Center Volume</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 57</td>
<td>1.2%</td>
</tr>
<tr>
<td>57 to 84</td>
<td>0.7%</td>
</tr>
<tr>
<td>85 to 124</td>
<td>1.0%</td>
</tr>
<tr>
<td>125 to 199</td>
<td>0.9%</td>
</tr>
<tr>
<td>&gt;200</td>
<td>1.3%</td>
</tr>
</tbody>
</table>

P=0.143
Patients at high risk for long-term mortality undergoing CEA by center
**What About CAS?**

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Median mrsc</th>
<th>% Asx</th>
<th>5-yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk, mrsc &lt;4 (n=115)</td>
<td>1.8</td>
<td>65%</td>
<td>80%</td>
</tr>
<tr>
<td>Intermediate risk, mrsc 4-12 (n=371)</td>
<td>6.8</td>
<td>65%</td>
<td>74%</td>
</tr>
<tr>
<td>High risk, mrsc&gt;12 (n=83)</td>
<td>14.4</td>
<td>49%</td>
<td>34%</td>
</tr>
</tbody>
</table>
**Higher Predicted Long Term Mortality Associated with Worse In-Hospital Outcomes After CAS**

Stroke Rate

- **Low risk**
  - MRS < 4
  - 5-yr 80%
  - 3.5%

- **Intermediate risk**
  - MRS 4-12
  - 5-yr 74%
  - 2.2%

- **High risk**
  - MRS > 12
  - 5-yr 34%
  - 6.0%

*P = 0.10*
Percent Patients at High Risk for Long Term Mortality Undergoing CAS by Center
SUMMARY

• A risk score for predicted long term mortality ....
  ▪ Allows for a standardized, granular, relevant comparison of patient selection across centers. May also be applied across surgeons and procedures.
  ▪ Analysis suggests there is significant variation in patient selection for CEA and CAS across centers.
SUMMARY

• A risk score for predicted long term mortality
  
  - May provide information relevant to patient selection for prophylactic procedures (Carotid or AAA).
    - By identifying patients who may no live long enough to derive benefit.
    - Analysis suggests that there is a small subset of patients (~5%) who undergo carotid revascularization in the VSGNE who probably won’t live long enough to experience benefit.
    - Counseling patients about in-hospital outcomes (high risk score associated with higher operative stroke or death).
Thank You
Generating Custom Reports using Pathways

- Carrie Bosela, RN
- Administrative Director, SVS PSO

- https://vqidemo.m2s.com
Next Meeting

- Date: Monday, May 5, 2014
- Location: Brigham and Women’s Hospital
- Time: 10 am – 4 pm
- Caregivers meeting: 8-10 am