Southeastern Vascular Study Group

May 12, 2016
10am-3pm
Emory University Atlanta, Georgia
SEVSG

Albany Vascular Specialist Center
Anderson Regional Medical Center
Athens Regional Medical Center
Baptist Hospital of Miami
Coastal Vascular & Interventional- PLLC
Florida Hospital
Floyd Medical Center
Grady Memorial Hospital (GA)
John F Lucas III- MD
Mayo Clinic Florida
Memorial Health University Medical
Memorial Hospital Pembroke
Memorial Hospital West
Memorial Regional Hospital
North Florida Regional Medical Center- Inc.
Northside Hospital Atlanta
Northside Hospital Cherokee
Northside Hospital Forsyth

Orlando Health - Dr. P. Phillips Hospital
Orlando Health - Orlando Regional
Orlando Health - South Seminole
Palm Beach Gardens Medical Center
Piedmont Hospital
Redmond Regional Medical Center
Sarasota Memorial Hospital
South Miami Hospital
St. Anthony's Hospital
Tampa Cardiovascular Associates
Tampa General Hospital
The Emory Clinic
The Vein and Vascular Institute of Tampa Bay
University of Alabama at Birmingham
University of Florida- Gainesville
Vascular Surgery Associates
Expanding Participation:

79 sites in Southeastern Region interested in VQI
Hand out by State on tables
Please reach out to sites where you know a possible physician champion
Launched by Society for Vascular Surgery in 2011

- **Mission:** To improve the quality, safety, effectiveness and cost of vascular health care by collecting and exchanging information.

- **3 Components:**
  - National Registries in a *Patient Safety Organization*
  - Regional Quality Improvement Groups
    - Based on Vascular Study Group of New England, 2002
  - Web-based data collection - reporting system
Patient Safety Organization (Patient Safety Act)

- Allows patient identified information to be collected for quality improvement without informed consent
- Protects work product (any comparative data) from discovery to encourage honest reporting
- Precludes comparative data to be used for physician disciplinary purposes or marketing
- Allows non-identifiable data to be published
  - Statistical de-identification of patient, provider, hospital
- Ideal vehicle for quality improvement registry
National Registries

- Carotid disease
  - Endarterectomy and stenting
- Aortic disease
  - Open and endovascular abdominal aneurysm repair
  - Endovascular repair thoracic aorta
- Lower extremity arterial disease
  - Bypass, interventional procedures, amputation
- Medical Management (in development)
- Dialysis access
- Vena cava filters
- Varicose veins
Advantages of SVS PSO Registry Data

• Allows data from all patients to be included
  – Not biased by those who only give consent

• Much more detailed information than claims data
  – Pre-, intra-, and post-op variables (> 150 per procedure)

• **One year follow-up for key outcomes**
  – Completed in physician’s office

• All consecutive procedures – allows rate calculation
  – Audited against hospital and physician claims data

• Longer follow-up with matched Medicare Claims
  – Survival also from Social Security Death Index
Big Data: 285,000 Procedures, 7,500 per Month

Hospital Types
- Community: 37%
- Academic: 32%
- Teaching Affiliate: 31%

376 Centers, 46 States + Ontario
Physician-Driven, Multi-Specialty Patient Safety Organization

2500 Specialists
All Procedures

- Vascular Surgery: 47%
- Radiology: 11%
- Cardiology: 17%
- General Surgery: 5%
- Cardiac Surgery: 4%
- Other: 4%

1600 Specialists
Interventional Procedures

- Vascular Surgery: 38%
- Cardiology: 26%
- Radiology: 26%
- General Surgery: 10%
New England QI Group Model - 2002

• Semi-annual meetings of physicians, nurses, researchers and administrators
• Analyze variation in process and outcomes among regional centers
• Discuss potential causes for variation
• Develop quality improvement projects in areas where substantial variation exists
• Promote ownership, collaboration, and greater opportunity to translate data into practice change
Network of 17 Regional Quality Groups

Semi-annual meetings, Review variation
Regional quality improvement projects
Regional Groups: Lessons Learned

• Comparative feedback stimulates practice change
  – Physicians are naturally competitive
  – We all want to improve our results
  – We all want to have the best results

• Most vascular patients should be on a statin pre-op
  – Record statin use
  – Feedback results to surgeons
VSGNE Pre-op Statin Use 2004

Initial 25 Surgeons
Vascular Quality Initiative

VSGNE Pre-op Statin Use 2007

Initial 25 Surgeons

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Pre-op Statin Use VSGNE 2003-2008

Vascular Quality Initiative®

Developed Letters to PCPs

Set QI Goal = 80%

Started QI Initiative

Percent

2003 2004 2005 2006 2007 2008

54% 62% 70% 78%
Regional Groups: Lessons Learned

- Comparative feedback stimulates practice change
- Large dataset can answer important clinical questions
  - Should I use protamine to reverse heparin during carotid endarterectomy?
    - Protamine reverses anticoagulant used during surgery, to promote clotting
  - Re-operation for bleeding: 1.7%
    - Concern about causing too much clotting: stroke, MI
  - Low frequency events cannot be studied in small series and randomized trials are unrealistic
VSGNE Surgeon Practice

4587 Total CEAs

Protamine: 2087 (46%)
No Protamine: 2500 (54%)

-Stone et al, J Vasc Surg, 2010
Reoperation for Bleeding

N=14
0.6%

N=42
1.7%
P=0.001

*P=0.001

Protamine
No Protamine

-Stone et al, J Vasc Surg, 2010
Thrombotic Complications

- Stone et al, J Vasc Surg, 2010

*P=NS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Protamine</th>
<th>No Protamine</th>
</tr>
</thead>
<tbody>
<tr>
<td>MI</td>
<td>1.1</td>
<td>0.91</td>
</tr>
<tr>
<td>Stroke</td>
<td>0.78</td>
<td>1.15</td>
</tr>
<tr>
<td>Death</td>
<td>0.23</td>
<td>0.32</td>
</tr>
</tbody>
</table>
Regional Groups: Lessons Learned

• Comparative feedback stimulates practice change
• Large dataset can answer important clinical questions
• Trusted analyses, reports can rapidly change practice
  – Physicians have ownership of regional group data
  – Protamine data were presented to regional group and published
Protamine use increased from 46% before 2009 to 61% after 2009 (P<.001).
Regional Groups: Lessons Learned

• Comparative feedback stimulates practice change
• Large dataset can answer important clinical questions
• Trusted analyses, reports can rapidly change practice
• Changed practice can improve outcomes
Protamine Use and Bleeding

Protamine Use
- Before 2009: 46%
- After 2009: 61%

P < .001

Re-operation for Bleeding
- Before 2009: 1.2%
- After 2009: 0.6%

P = .003

-Patel et al, J Vasc Surg 2013
Current QI Projects in VQI Regional Groups

- Increasing use of antiplatelet and statin use pre-op and at DC
- Decreasing myocardial infarction after arterial procedures
- Optimizing graft type choice for leg bypass
- Enhancing recovery after lower extremity amputation
- Reducing length of stay after VQI procedures
- Improving long term follow up of patients in VQI
- Reducing preventable causes of readmissions
- Preventing contrast-induced nephropathy after arteriography
- Increasing smoking cessation after major arterial procedures
COPI Reports

- Center Opportunity Profile for Improvement

- Analyze and report variation in outcome

- Multivariable model to define causes of outcome

- Individual report to each center:
  - How they compare with others for the outcome and each factor associated with the outcome
  - Provides a customized, actionable improvement plan for each center
Significant variation found across VQI participating centers and regions

Risk factors associated with SSI:
- Operation > than 220 minutes
- Transfusion > 2 units PRBC
- Skin prep not chlorhexidine
COPI Report for SSI after Lower Extremity Bypass

<table>
<thead>
<tr>
<th>Predictors of wound infection</th>
<th>VQI Average</th>
<th>Your Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorhexidine</td>
<td>79%</td>
<td>Higher is better</td>
</tr>
<tr>
<td>Transfusion &lt; 3 Units</td>
<td>85%</td>
<td>Higher is better</td>
</tr>
<tr>
<td>Procedure time &lt; 220 minutes</td>
<td>50%</td>
<td>Higher is better</td>
</tr>
</tbody>
</table>

### Your center's number of procedures
- VQI wound infection rate: 3.8%
- Your center's wound infection rate: 9.4%
- Your center’s wound infection expected rate: 4.6%
- Observed rate vs. Expected rate: P<.05

**Improvement Opportunity**
- Switch to Chlorhexidine. Reduce number of transfusions.
### COPI Report for SSI after Lower Extremity Bypass

<table>
<thead>
<tr>
<th>COPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your center’s number of procedures</td>
</tr>
<tr>
<td>VQI wound infection rate</td>
</tr>
<tr>
<td>Your center’s wound infection rate</td>
</tr>
<tr>
<td>Your center’s wound infection expected rate</td>
</tr>
<tr>
<td>Observed rate vs. Expected rate</td>
</tr>
</tbody>
</table>

#### Predictors of wound infection

<table>
<thead>
<tr>
<th>VQI Average</th>
<th>Chlorhexidine (Higher is better)</th>
<th>Transfusion &lt; 3 Units (Higher is better)</th>
<th>Procedure time &lt; 220 minutes (Higher is better)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your center</td>
<td>79% (32%)</td>
<td>85% (60%)</td>
<td>50% (49%)</td>
</tr>
</tbody>
</table>

**Your Center**

Improvement Opportunity

Switch to Chlorhexidine. Reduce number of transfusions.
Chlorhexidine Skin Prep Use

Percentage

1/2/12 2/2/12 3/2/12 4/2/12 5/2/12 6/2/12 7/2/12 8/2/12 9/2/12 10/2/12 11/2/12 12/2/12 1/2/13 2/2/13 3/2/13 4/2/13 5/2/13 6/2/13 7/2/13 8/2/13 9/2/13 10/2/13 11/2/13 12/2/13

79%

93%

COPI Report
Centers with Most Improvement in Chlorhexidine Use

Chlorhexidine Use

Infection Rate

2011 2013

2011 2013
Value of VQI Participation

- Does participation in VQI (receiving benchmark reports, attending regional meetings, etc.) improve patient outcomes?
Late Survival after Major Arterial Procedures

- 50,000 Patients in VQI who underwent
  - Leg bypass / intervention, oAAA / EVAR, CEA / CAS
- Evaluated pre-operative and discharge medications:
  - Antiplatelet agent (ASA, PY212 inhibitors)
  - Statins (HMG-CoA reductase inhibitors)
- Outcomes analyzed:
  - Effect on patient survival
  - Variation across centers
  - Impact of participation in VQI

Effect of Discharge Medications on Survival

26% Absolute improvement in 5-year survival when patients are discharged on AP & Statin

P<0.001 SE < 0.1

Variation in % Patients Discharged on Anti-platelet and Statin

VQI Mean = 76%

30% - 100%
Patients on Antiplatelet and Statin Pre-op and Discharge Based on Center Years Participation in VQI

Number of Years Participating in VQI

<table>
<thead>
<tr>
<th>Years</th>
<th>Participation Rate</th>
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<tbody>
<tr>
<td>1</td>
<td>58%</td>
</tr>
<tr>
<td>2</td>
<td>56%</td>
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<tr>
<td>3</td>
<td>58%</td>
</tr>
<tr>
<td>4</td>
<td>61%</td>
</tr>
<tr>
<td>5</td>
<td>65%</td>
</tr>
<tr>
<td>6</td>
<td>69%</td>
</tr>
<tr>
<td>7</td>
<td>70%</td>
</tr>
</tbody>
</table>
New VQI Initiatives

- Evaluating appropriateness of treatment
Appropriate Treatment
• Appropriate treatment requires not only good early and late outcomes, but also:
  – Correct patient selection
  – Correct procedure selection
• VQI provides an opportunity to analyze variation in patient and procedure selection
  – Feedback data to centers
  – Goal: regression toward the mean and reduced variation
• Current data show large variation!
Carotid Artery Treatment by Stent (vs endarterectomy)

All VQI Centers Mean = 13% Stent Rx

Procedure Selection Variation

VQI Centers
Carotid Artery Treatment in Asymptomatic Patients

All VQI Centers Mean = 77% Asymptomatic

Patient Selection Variation

29% Asymptomatic
Variation in Ultrasound Criteria for Severe Disease

Disease Severity Judged by Blood Flow Velocity in Narrowed Artery

- Median Velocity = 360 cm/sec
- PSV = 550 cm/sec
  - More Severe Disease: Fewer Procedures

Patient Selection Variation: Substantial Opportunity

- Less Severe Disease: More Procedures
  - PSV = 50 cm/sec
Arterial Quality Council Update:
Roles of the Module Committees

- Participation in all AQC calls (or designation of an alternative) this applies to all AQC members
- Yearly report generation including:
  - Identification of opportunities for improvement of the module (compile a list of data points that can be changed, removed or added)
  - LTFU within the module
  - Missing variable report
  - Data trends and outcomes
- Evaluation of PQRS/QCDR measure from their respective module, and identification of possible quality initiatives
- Generation of risk calculators and yearly updates to the models
Statistical Audits

• Analyzing sites with high risk and low to zero outcomes
  – validate data that might be under-reported, such as complications

• Pilot with oAAA:
  – The POMI rate for non-urgent OAAA in the data = 5.3%.
  – after developing a model to predict post op MI after open AAA repair we audited 173 cases with highest risk for MI, and found 5.8% previously not reported MI
  – Based on the model, we estimate that the under-reporting rate for MI after all open AAA cases is 1.9%
National QI projects:

Statin/AP therapy
Follow-up imaging after EVAR
Appropriateness of care
Research Advisory Council Update:
Research Advisory Council (RAC)

Approved Project list on line:


Quality Research-Related

- VQI Approved Projects List – December 2015
- List of VQI Presentations – November 2015
- List of VQI Publications – November 2015
- National Quality Research Dataset Request Process
- Regional Quality Research Dataset Request Process
- VQI Presentations – VAM 2014

Society for Vascular Surgery
m2s
Society for Vascular Medicine
Research Advisory Council (RAC)

National Proposals New Portal for Submission:

http://abstracts123.com/svs1/
# Research Advisory Council (RAC)

Hi Carrie Bosela,

Log out

## Application Summary

<table>
<thead>
<tr>
<th>Total Applications</th>
<th>Submitted</th>
<th>Incomplete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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## My Applications

<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
<th>Category</th>
<th>Status</th>
<th>Date Submitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>2218</td>
<td>Peripheral Vascular Intervention for Claudication</td>
<td></td>
<td>Pending</td>
<td></td>
</tr>
</tbody>
</table>

## Applications I am a Co-Investigator on

No applications found
Venous Quality Council Update:
IVC Filter Registry

- 4740 procedures
- Current workgroup developing an IVC filter retrieval reminder report/email notification
- **CMS Quality Measure**: Appropriate management of Retrievable IVC filters
Varicose Vein Registry

• 3456 procedures
• Focus on vein centers, integrate with vein-specific EMR vendors
  – VeinSpec
  – SonoSoft
  – StreamlineMD
  – MedStreaming
• Includes Quality of Life variables
Conclusions
The VQI VVR provides complete assessment of varicose vein interventions, and is useful for monitoring changes after treatment. Modern day varicose vein surgery is characterized by predominately endovenous treatment of axial vein reflux, phlebectomy of clusters, and dramatic improvements in both VCSS and patient reported outcomes.
Governing Council Update:
Regional Reports:
Please review your center level reports

Note: In all reports, regional data are not shown for regions with <3 centers participating in the applicable registry. In "by Center" bar charts, unless noted, data are not shown for centers with <10 cases.
<table>
<thead>
<tr>
<th>Your region</th>
<th>Follow-up rate (N)</th>
<th>VQI</th>
<th>Follow-up rate (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>49% (150)</td>
<td>53%</td>
<td>(2025)</td>
</tr>
<tr>
<td>CEA</td>
<td>61% (657)</td>
<td>55%</td>
<td>(11261)</td>
</tr>
<tr>
<td>EVAR</td>
<td>57% (270)</td>
<td>57%</td>
<td>(4543)</td>
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<tr>
<td>HEMO</td>
<td>77% (607)</td>
<td>61%</td>
<td>(4517)</td>
</tr>
<tr>
<td>INFRA</td>
<td>59% (342)</td>
<td>59%</td>
<td>(4789)</td>
</tr>
<tr>
<td>OAAA</td>
<td>57% (77)</td>
<td>61%</td>
<td>(1149)</td>
</tr>
<tr>
<td>PVI</td>
<td>64% (273)</td>
<td>49%</td>
<td>(14833)</td>
</tr>
<tr>
<td>SUPRA</td>
<td>49% (153)</td>
<td>52%</td>
<td>(1751)</td>
</tr>
<tr>
<td>TEVAR</td>
<td>74% (127)</td>
<td>48%</td>
<td>(842)</td>
</tr>
<tr>
<td>2013 Overall</td>
<td>64% (2656)</td>
<td>54%</td>
<td>(45710)</td>
</tr>
<tr>
<td>2012 Overall</td>
<td>77% (1905)</td>
<td>71%</td>
<td>(32070)</td>
</tr>
<tr>
<td>Your region</td>
<td>Follow-up rate (N)</td>
<td>VQI</td>
<td>Follow-up rate (N)</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------</td>
<td>-----</td>
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<tr>
<td>CAS</td>
<td>60% (149)</td>
<td></td>
<td>63% (1989)</td>
</tr>
<tr>
<td>CEA</td>
<td>71% (658)</td>
<td></td>
<td>67% (11121)</td>
</tr>
<tr>
<td>EVAR</td>
<td>65% (266)</td>
<td></td>
<td>68% (4456)</td>
</tr>
<tr>
<td>HEMO</td>
<td>84% (601)</td>
<td></td>
<td>71% (4364)</td>
</tr>
<tr>
<td>INFRA</td>
<td>75% (340)</td>
<td></td>
<td>71% (4701)</td>
</tr>
<tr>
<td>OAAA</td>
<td>73% (77)</td>
<td></td>
<td>71% (1125)</td>
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<tr>
<td>PVI</td>
<td>83% (262)</td>
<td></td>
<td>61% (14501)</td>
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<tr>
<td>SUPRA</td>
<td>60% (153)</td>
<td></td>
<td>66% (1722)</td>
</tr>
<tr>
<td>TEVAR</td>
<td>82% (127)</td>
<td></td>
<td>62% (850)</td>
</tr>
<tr>
<td>IVCF*</td>
<td></td>
<td>80%</td>
<td>(360)</td>
</tr>
<tr>
<td><strong>2013 overall</strong></td>
<td>75% (2699)</td>
<td></td>
<td>66% (45189)</td>
</tr>
<tr>
<td><strong>2012 overall</strong></td>
<td>77% (1909)</td>
<td></td>
<td>72% (31941)</td>
</tr>
</tbody>
</table>
Vascular Quality Initiative®

Fall 2015-LTFU Reports

Center Variation in Your Region (2013)

Regional Variation across VQI (2013)

* indicates region's rate is significantly different than overall VQI rate
"Others" indicates centers that do not belong to a regional group
Vascular Quality Initiative®

Spring 2016-LTFU Reports

LTFU by Center in Your Region (2013)

LTFU by Region across VQI (2013)

* Indicates region's rate is significantly different than overall VQI rate.
"Others" indicates centers that do not belong to a regional group.
Transparency with LTFU: show center names on the graph?

- Due to the start of participation award
- Supported by the Executive Committee of the Governing Council
- Does not violate any PSO regulations
- Vote: Optional by region
Discharge Medications Antiplatelet and Statin (2015)
Excludes missing, not treated for medical reason and non-compliant

A+S Rate by Center in Your Region (2015)

A+S Rate by Region across VQI (2015)

* Indicates region's rate is significantly different than overall VQI rate
"Others" indicates centers that do not belong to a regional group
Want to Improve 5-Year Survival? Check the Meds...

Antiplatelet (AP) and statin medications are an important component to treatment, but a third of eligible post-op VQI patients leave the hospital without these medications. **Those patients on AP and statins had a 14% absolute survival benefit and 40% adjusted improved survival.**

**Survival by Discharge Medications**

<table>
<thead>
<tr>
<th>No AP or statin</th>
<th>AP &amp; Statin</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Survival Icons" /></td>
<td><img src="image" alt="Survival Icons" /></td>
</tr>
</tbody>
</table>

- For every 25 patients treated, discharge on an antiplatelet agent and statin medication is associated with 3.5 additional patients alive at 5 years!
- VQI participation is highly associated with improvement in medication use.
Conclusion:
Medical management is associated with improved survival after a number of vascular procedures. Importantly, VQI participation improves the use of medical management, demonstrating that involvement in an organized quality effort can affect patient outcomes.

Percentage of Infrainguinal Bypass Procedures with Chlorhexidine or Chlorhexidine + Alcohol Skin Prep (2015)

Chlorhexidine Rate by Center in Your Region (2015)

Chlorhexidine Rate by Region across VQI (2015)

* Indicates region's rate is significantly different than overall VQI rate.
"Others" indicates centers that do not belong to a regional group.
Excludes cut-down

Rate of US Guidance by Center in Your Region (2015)

Rate of US Guidance by Region across VQI (2015)

* Indicates region's rate is significantly different than overall VQI rate.
PVI: Percent of Patients with ABI or TBI Assessed Before Procedure (2015)

“ABI or TBI Assessed” indicates at least one measure was recorded for the side of the procedure, or on both sides for bilateral and aortic procedures.

ABI/TBI Assessment by Center in Your Region (2015)

ABI/TBI Assessment by Region across VQI (2015)

* Indicates region’s rate is significantly different than overall VQI rate.
EVAR: Rate of Sac Diameter Reporting at Long-Term Follow Up 2013, excluding patients without at least 9 month follow up

Sac Diameter Reporting by Center in Your Region (2013-14)

Sac Diameter Reporting by Region across VQI (2013-14)

* Indicates region’s rate is significantly different than overall VQI rate.
TEVAR: Rate of Sac Diameter Reporting at Long-Term Follow Up 2013, excluding patients without at least 9 month follow up

*S Indicates region's rate is significantly different than overall VQI rate.*
Carotid Endarterectomy

Percentage of Patients with Length of Stay > 1 Day

2015, elective procedures, excluding prior ipsilateral CEA, concomitant CABG, proximal endovascular or other arterial operation, in hospital death with LOS <= 1 day, procedures done on weekends or not done on admission day.

CEA LOS >1 Day by Center in Your Region (2015)

CEA LOS >1 Day by Region across VQI (2015)

* = Region's rate is significantly different than expected
Endovascular AAA Repair: Percentage of Patients with Length of Stay >2 Days

2015 procedures, excluding symptomatic, ruptured, prior aortic surgery, in-hospital deaths with LOS<=2 days, procedures not done on day of admission and weekend
Open AAA Repair:
Percentage of Patients with Length of Stay >= 8 Days

2015 procedures, excluding ruptured aneurysms and in hospital deaths with LOS<=8 days, procedures not done on day of admission and weekend procedures
Hemodialysis Access: Percentage of Primary AVF vs. Graft

2015 procedures, excludes patients receiving AVF access who have received previous access in the forearm, upper arm or basilic vein on the same side

Primary AVF Access by Center in Your Region (2015)

Primary AVF Access by Region across VQI (2015)

* Indicates region’s rate is significantly different than overall VQI rate.
IVC Filter: Percentage of Temporary Filters with Retrieval or Attempt at Retrieval
2015 procedures, excluding patients who have died since discharge

IVCF Retrieval by Region across VQI (2014)

* Indicates region’s rate is significantly different than overall VQI rate.
Carotid Artery Stent: Stroke or Death in Hospital
2015 procedures, elective, excluding prior ipsilateral CAS
Carotid Endarterectomy: Stroke or Death in Hospital
2015 procedures, elective, excluding prior ipsilateral CEA and concomitant CABG

CEA Stroke or Death by Center in Your Region (2015)

CEA Stroke or Death by Region across VQI (2015)

YR=Your Region; * = Region's rate is significantly different than expected
Infrainguinal Bypass: Percentage of Major Complications

2015 procedures, Major complications= In hospital death, ipsilateral amputation or graft occlusion.
Includes only patients with Indication=Rest Pain or Tissue Loss
Open Non-ruptured AAA: In hospital Mortality
2015 procedures, excluding weekend procedures
National VQI Update:
Carrie Bosela, SVS PSO
377 Centers, 46 States + Ontario
17 Regional Quality Groups

- Pacific NW Vascular Study Group
- Mid-America Vascular Study Group
- Midwest Vascular Collaborative
- Upper MidWest Vascular Network
- Great Lakes Vascular Study Group
- Vascular Study Group of New England
- Vascular Study Group of Greater New York
- Mid-Atlantic Vascular Study Group
- Virginias Vascular Study Group
- Carolinas Vascular Quality Group
- MidSouth Vascular Study Group
- Southern Vascular Outcomes Network
- Southeastern Vascular Study Group
- Rocky Mountain Vascular Quality Initiative
- Northern California Vascular Study Group
- Southern California Vascular Outcomes Improvement Collaborative

AK
HI
### Total Procedures Captured (as of 5/1/2016)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
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<tbody>
<tr>
<td>Peripheral Vascular Intervention</td>
<td>92,107</td>
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<tr>
<td>Carotid Endarterectomy</td>
<td>67,163</td>
</tr>
<tr>
<td>Infra-Inguinal Bypass</td>
<td>30,420</td>
</tr>
<tr>
<td>Endovascular AAA Repair</td>
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<td>Varicose Vein</td>
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</table>

### VQI Total Procedure Volume

![Graph showing the VQI Total Procedure Volume from Jan-14 to Apr-16](chart.png)
VQI 1st Annual Meeting

June 8, 2016

- 8:00am to 12:00 pm Data Managers Session
  • Interactive Panel Discussion on Key Registry Topics
  • PVI case abstraction
  • Producing and Interpreting Reports

- 12:00pm to 5:00pm All VQI Participants
  • Key Note Speaker: Dr. Englesbe
  • Utilizing Registries for QI Opportunities: Dr. Ted James
  • VQI QI success stories: Memorial South Bend, Carolinas Vascular Quality Initiative, Beaumont Health System, El Camino
VQI Participation Award
Participation Award

Meeting-Participation Score*

(based on Fall 2015 meeting attendance: max 3)

- No MD from site attends = 0 points
- 1 MD from site attends = 1 point
- 2 MDs attend (or 1 MD if site has only 2 MDs) = 2 points
- 3 MDs attend (or all MDs if site has <3 MDs) = 3 points

*Additional health professional staff attendance (Data Manager, Admin, NP, PA, Fellow, etc.,) = one additional point if 1 MD attended. Phone attendance does count!
Participation Award

**Long-Term Follow-Up Score**

(based on 2013 procedures)

- <70% mean LTFU in all registries = 0 points
- 70% mean LTFU in all registries = 1 point
- 80% mean LTFU in all registries = 2 points
- 90% mean LTFU in all registries = 3 points
Participation Award

Registry-Subscription Score
(as of December 2015)

– Subscribe to 1-2 registries = 0 points
– Subscribe to 3-5 registries = 1 point
– Subscribe to 6-8 registries = 2 points
– Subscribe to 9-12 registries = 3 points
Participation Award

- Zero stars: < 3 points
- One star: At least 3 points
- Two stars: At least 5 points
- Three stars: At least 7 points
2016 Participation Award Results

- 0 stars: 42% centers
- 1 star: 23% centers
- 2 stars: 26% centers
- 3 stars: 9% centers
Long Term Follow UP < 50%

• Centers with LTFU less than 50% will receive mentoring from a peer advisor and a LTFU toolkit from the PSO to assist them in improving their LTFU rates

• This toolkit is in the resource tab of the VQI website
Long Term Follow UP < 50%

• Centers on probation cannot receive data for research until their LTFU is >50%

• Centers on probation will continue to receive regional reports that look at a long term outcomes, but their center data will not be calculated, because it is not judged to be accurate if LTFU is < 50%.

• Centers on probation will not be permitted to participate in new industry-sponsored projects to assess device performance if LTFU is included in these projects, since complete reporting is critical for these projects.
Vascular Quality Initiative

VQI tools for success

Resource Library
- Cardiac Risk Predictor
- VQI Risk Model – Carotid Endarterectomy
- VQI Risk Model – EVAR
- VQI Risk Model – Infrainguinal Bypass
- VQI Risk Model – Open AAA Repair
- Time Savings Calculator
- LTFU Toolkit: Follow Up Card Template
- LTFU Toolkit: Suggestions for Success
- DC Medication Flyer
Vascular Quality Initiative®

It’s important to see your physician for your follow up appointment to:

- Monitor your post-procedure care
- Understand any complications
- Discuss your medications

Vascular Quality Initiative®

A national quality program of over 2,800 specialist physicians dedicated to improving vascular care, with the Society of Vascular Surgery, American Venous Forum, and Society for Vascular Medicine.

FOLLOW UP APPOINTMENT

To ensure your vascular health

Your specialist: (physician name)
Follow up visit: (date)
Location: (facility)

As members of the Vascular Quality Initiative®, you and your physician can work together to improve your vascular health. www.vascularqualityinitiative.org
VQI Best Practices

- A physician champion is critical to the success of LTFU. The physician champion communicates to his/her VQI team that LTFU is essential for good patient care and improved outcomes.
- Report cards that display the center’s current LTFU rate and track improvement should be provided weekly or monthly to the VQI team (see how to run a report in Appendix). Report cards might also include lists of VQI patients who are due or past due for a follow-up visit.
- Some sites have tied hospital credentialing and staff evaluations.raises to the success of achieving LTFU of 80% or greater.
VQI Best Practices

- Start reviewing electronic records at the 9-month post-procedure time point.
- Send a list of patients who need a follow-up appointment to office staff.
- Key is to make a follow-up appointment at the time of the surgical procedure.
- If no vascular appointment will be made inside the window of 9-21 months post procedure, use another appointment (i.e. PCP, endocrine, cardiac, oncology) to collect data.
- If the patient will not be returning for an appointment, call at home. Calling outside of work hours is often successful.
- Call the emergency contact in the medical record, if unable to reach the patient directly.
- Internet Search- patient’s name and city will bring up obituaries, new addressed or other family members to contact.
- Email the patient if the address is given in the medical record.
Medicine Registry Update
Medicine Registry

• Scope
  – Medical management of:
    • Lower extremity PAD
    • Carotid stenosis
    • AAA
  – New outpatient consults that require follow up
  – One year follow up required, longer possible
Medicine Registry

• Progress
  – Variables/Definitions completed April 2016
  – M2S will mock up the specs by May 2016
  – Webinars and public comment in June 2016
  – Release sometime 2016 3rd or 4th Quarter
Physician and COPI Reports
(Center Opportunity Profile for Improvement)

2016 planned reports:

– CEA Stroke/Death
– CAS Stroke/Death
– Long term imaging after EVAR
– Major complications after oAAA
– PVI Hematoma
– Amputation free survival after Infra/Supra
EVAR Cost Pilot: MedAssets

- 18 VQI sites participating in Pilot
  - Understanding the economics of vascular procedures is critically important
  - Combined hospital cost data (MedAssets) with detailed clinical data (VQI) to accurately benchmark similar procedures
EPIC Update

• Dr. Michael Stoner and Lisa Spellman at University of Rochester
  – Working with Epic to build CEA form that can be transferred via JSON file to M2S
  – Work should be done and ready for testing end of April 2016
  – “How to” documentation will be shared with all VQI EPIC users
Regulatory

• Meaningful Use (EHR)
• Medicare Access and CHIP Reauthorization Act of 2015 (MACRA)
• Merit-Based Incentive Payment System (MIPS)
• Alternative Payment Models (APM)
• Physician Quality Reporting System (PQRS)
• Qualified Clinical Data Registry (QCDR)
Meaningful Use

VQI meets objective 10, measure 3: use of a specialized registry for meaningful use per CMS only if members subscribe and use “DATA IMPORT”
Meaningful Use

Letter of Intent on the VQI web:

Pathways Development Update
Report Name: Elective Endo AAA Repair

Procedure Type(s): Endo AAA Repair

View: Select Centers

Hide Health System Results

Results

<table>
<thead>
<tr>
<th>Procedure Variable Name</th>
<th>Generic Medical Center (N = 159)</th>
<th>My Health System (N = 3412)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (inches)</td>
<td>64.6 ± 3.5; 66.0</td>
<td>64.6 ± 3.5; 66.0</td>
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<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Indian or Alaskan Native</td>
<td>0.2% (3)</td>
<td>0.2% (137)</td>
</tr>
<tr>
<td>Black or African American</td>
<td>18.6% (28)</td>
<td>18.6% (376)</td>
</tr>
<tr>
<td>Native Hawaiian or other Pacific Islander</td>
<td>0.1% (1)</td>
<td>0.1% (57)</td>
</tr>
<tr>
<td>White</td>
<td>80.4% (121)</td>
<td>80.4% (2789)</td>
</tr>
<tr>
<td>More than 1 race</td>
<td>0.1% (1)</td>
<td>0.1% (48)</td>
</tr>
<tr>
<td>Unknown / Other</td>
<td>0.6% (5)</td>
<td>0.6% (5)</td>
</tr>
<tr>
<td>Death</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>99% (157)</td>
<td>99% (3410)</td>
</tr>
<tr>
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<td>0% (0)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Missing Value or N/A</td>
<td>1% (2)</td>
<td>1% (2)</td>
</tr>
</tbody>
</table>
## Elective Endo AAA Repair

### Procedure Type(s): Endo AAA Repair

**View:**
- [ ] Center
- [ ] Physician
- [ ] Select Centers

- [ ] Generic Medical Center
- [x] John Smith Medical Center
- [ ] John Doe Medical Center
- [ ] Jane Smith Medical Center
- [ ] Jane Doe Medical Center

- [ ] Hide Health System Results

---

**Results**

<table>
<thead>
<tr>
<th>Procedure Variable Name</th>
<th>Generic Medical Center (N = 159)</th>
<th>My Health System (N = 3412)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Height (inches)</strong></td>
<td>$64.6 \pm 3.5, 66.0$</td>
<td>$64.6 \pm 3.5, 66.0$</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
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<tr>
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<td>$0.2% (3)$</td>
<td>$0.2% (137)$</td>
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<tr>
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<td>$0.1% (57)$</td>
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<tr>
<td>White</td>
<td>$80.4% (121)$</td>
<td>$80.4% (2789)$</td>
</tr>
</tbody>
</table>
### Elective Endo AAA Repair

**Procedure Type(s):** Endo AAA Repair  
**Regional Group:** Trial Registry  
**PSO Benchmarking:**  
- Center  
- Regional  
- National  
**View:**  
- Center  
- Physician  
- Select Physicians  
- Hide Health System Results  

**Report Name:** Elective Endo AAA Repair

**Procedure Variable Name** | **Generic Medical Center** (N = 159) | **John Smith** (N=250) | **Jane Smith** (N=250) | **My Health System** (N = 3412) | **All Other Regional Participants** (N = 15300) | **All Other National Participants** (N = 154500) | **Charts** | **Reg Lvl**  
--- | --- | --- | --- | --- | --- | --- | --- | ---  
**Height (inches)** | 64.6 ± 3.5, 66.0 | 64.6 ± 3.5, 66.0 | 64.6 ± 3.5, 66.0 | 64.6 ± 3.5, 66.0 | 64.6 ± 3.5, 66.0 | 64.6 ± 3.5, 66.0 |  
**Race** | | | | | | |  
- **American Indian or Alaska** | 0.2% (3) | 0.2% (3) | 0.2% (3) | 0.2% (137) | 0.2% | 0.2% | ![Graph](https://example.com/graph1) | ![Graph](https://example.com/graph2) |  
- **Black or African American** | 18.6% (28) | 18.6% (28) | 18.6% (28) | 18.6% (376) | 18.6% | 18.6% | ![Graph](https://example.com/graph3) | ![Graph](https://example.com/graph4) |  
- **Native Hawaiian or other Pacific Islander** | 0.1% (1) | 0.1% (1) | 0.1% (1) | 0.1% (57) | 0.1% | 0.1% | ![Graph](https://example.com/graph5) | ![Graph](https://example.com/graph6) |  
- **White** | 80.4% (121) | 80.4% (121) | 80.4% (212) | 80.4% (2789) | 80.4% | 80.4% | ![Graph](https://example.com/graph7) | ![Graph](https://example.com/graph8) |  
- **More than 1 race** | 0.1% (1) | 0.1% (1) | 0.1% (1) | 0.1% (48) | 0.1% | 0.1% | ![Graph](https://example.com/graph9) | ![Graph](https://example.com/graph10) |  
- **Unknown / Other** | 0.6% (5) | 0.6% (5) | 0.6% (5) | 0.6% (5) | 0.6% | 0.6% | ![Graph](https://example.com/graph11) | ![Graph](https://example.com/graph12) |  
**Death** | | | | | | |  
- **No** | 99% (157) | 99% (15) | 99% | 99% | 99% | 99% | ![Graph](https://example.com/graph13) | ![Graph](https://example.com/graph14) |  
- **Yes** | 0% (0) | 0% (0) | 0% (0) | 0% | 0% | 0% | ![Graph](https://example.com/graph15) | ![Graph](https://example.com/graph16) |  
- **Missing Value or N/A** | 1% (2) | 1% (2) | 1% (2) | 1% | 1% | 1% | ![Graph](https://example.com/graph17) | ![Graph](https://example.com/graph18) |  

[Download as PDF](#)
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<th>Procedure Variable Name</th>
<th>Generic Medical Center ( (N = 159) )</th>
<th>John Smith Medical Center ( (N = 250) )</th>
<th>My Health System ( (N = 3412) )</th>
</tr>
</thead>
<tbody>
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<td>( 64.6 \pm 3.5, 66.0 )</td>
<td>( 64.6 \pm 3.5, 66.0 )</td>
</tr>
<tr>
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<td>American Indian or Alaskan Native</td>
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<td>0.2% (3)</td>
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<td>18.6% (376)</td>
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<tr>
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<td>80.4% (2789)</td>
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<td>More than 1 race</td>
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<tr>
<td>Unknown / Other</td>
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<td>0.6% (5)</td>
<td>0.6% (5)</td>
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<tr>
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<tr>
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<td>99% (157)</td>
<td>99% (248)</td>
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<td>Patient18</td>
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<tr>
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<td>Patient21</td>
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<td>Patient30</td>
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</tr>
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</table>
2016 Q1 Projects

• **Develop new PVI registry**
  - New procedure and follow-up forms
  - Concomitant procedure feature with INFRA and SUPRA
  - Device data integration with/ import of FDA UID/GUDID registry
  - QCDR/PQRS measure updates for 2 PVI QCDR process measures, 1 PVI QCDR outcome measure, and 2 PVI PQRS measures
  - Standard data import for new PVI registry

• **Add IDE devices on EVAR and TEVAR registries**
TEVAR Dissection Postmarket Surveillance

- **Sponsors:** Medtronic and W.L. Gore
- **Sites** have received $519,800 as of 12/31/2015 as compensation for their time.
- **FDA** has received 2 summary reports (non-identifiable data)
- **Steering Committee** is drafting an initial journal article highlighting the project design and the impact on quality improvement
- **5 year participation in acute arm is complete!!!!**

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Enrolling new sites</th>
<th>Number of Sites</th>
<th>Number of Patients</th>
<th>Follow Up</th>
<th>Reimbursement</th>
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</thead>
<tbody>
<tr>
<td>5 Year</td>
<td>No</td>
<td>50</td>
<td>400 (389 patients enrolled)</td>
<td>At 30 days and annually for 5 years</td>
<td>Per Subject: $4,000 - $1300 Initial Treatment - $400 Each follow up visits - $700 Final 5 year follow up $700 Add’ l intervention</td>
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<tr>
<td>1 Year</td>
<td>Yes</td>
<td>Up to 50</td>
<td>200 (46 patients enrolled)</td>
<td>Annually for 1 year</td>
<td>$400 for each procedure with a completed 1 year follow up</td>
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Lombard Aorfix Postmarket Surveillance

- Sponsor: Lombard Medical
- EVAR Registry
- Sites have received $43,500 as of 12/31/2015 as compensation for their time.
- Lombard has received 2 data reports (non-identifiable data)

<table>
<thead>
<tr>
<th>Enrolling</th>
<th>Number of Sites</th>
<th>Number of Patients</th>
<th>Follow Up</th>
<th>Reimbursement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>50</td>
<td>234 (35 patients enrolled)</td>
<td>At 30 days and annually for 5 years</td>
<td>Per Subject: $4,000 - $1,300 Initial Treatment - $400 Each follow up visits - $700 Final 5 year follow up $700 Add’ l intervention</td>
</tr>
</tbody>
</table>
CREST 2 Registry Project

- CAS Registry with Supplemental 1-page form
- Enrolling
- 64 Physicians are participating through VQI
- Objectives
  - Promote rapid initiation and completion of enrollment in the CREST-2 trial
  - Ensure that CAS is performed by adequately experienced operators within CREST-2 and C2R
  - Closely monitor clinical outcomes of C2R patients
  - Prevent inappropriate use of CAS outside of C2R
- C2R Investigators have received 10 reports
  - Patient-level data is non-identifiable per HIPAA
  - Physician and center names are transferred IAW project data sharing agreement
Will Jordan, MD
Emory University
Aligning coders with caregivers: the importance of accurate data entry

William D. Jordan, Jr., M.D.
Professor and Chief
Division of Vascular Surgery and Endovascular Therapy
Emory University
Atlanta, Georgia
GIGO

Garbage In = Garbage Out
Garbage In, Garbage Out

YOUR ANALYSIS IS ONLY AS GOOD AS YOUR DATA

\[ f(\text{garbage}) = \text{garbage} \]
Aligning the Data

RESEARCH MISCUE

• TEVAR study – tracking behavior of aneurysms after endograft

• Data entry from each site
  – ENTERED: 40 mm increase in size
  – REALITY: 4.0 mm increase in size
• Simple mis-keying
• Miscommunication from patient
• Wrong entry of data
  – WNL → within normal limits
  – WNL → “We never looked!”
• Delays in ADT – admissions, discharge, transfer
• Timeliness of data entry
NSQIP MISCUE

- Pneumonia after AAA surgery → 25%
  - “Outlier!!!”
  - euphemism for BAD

- Separate surgical review → coder was classifying ALL post op CXR with indication “R/O pneumonia” as “pneumonia”

- Reclassified pneumonia rate → 6%
  - “Data already submitted, we cannot change the report”
NSQIP MISCUE – PART 2

- Coding error corrected ✔
- Next reporting period, pneumonia rate recorded at 4.5%
- Site receives award for Most Improved!
OUTCOMES VARY BY DATABASE

- 240 patients LE bypass
  - U Mass
  - 2007-2012

- Pre-op match

- Post-op mismatch
HARD VARIABLES CORRELATE WELL

Length of Hospital Stay in VQI Dataset vs. Length of Hospital Stay in NSQIP Dataset

Correlation Coefficient = 0.97
N = 240

*Length of stay in days
POST OP VARIABLES DO NOT MATCH
BAD DATA CREATES MORE PROBLEMS

USE THE CRS DATABASE TO SIZE THE MARKET. THAT DATA IS WRONG.

THEN USE THE SIBS DATABASE. THAT DATA IS ALSO WRONG.

CAN YOU AVERAGE THEM? SURE, I CAN MULTIPLY THEM TOO.
COMPARING NSQIP TO CHART REVIEW

- 1342 patients
  - 2005-2011
  - 392 → NSQIP

- NSQIP failed to ID
  - Symptomatic status
  - Physiologic high risk
  - Anatomic high risk
Aligning the Data

Table II. Comparison of outcomes analysis using administrative data and physician chart review in 1342 patients who underwent CEA or CAS between 2005 and 2011

<table>
<thead>
<tr>
<th></th>
<th>Administrative data</th>
<th>Physician chart review</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Symptomatic</td>
<td>228</td>
<td>17.0</td>
</tr>
<tr>
<td>Physiologic high risk</td>
<td>125</td>
<td>9.3</td>
</tr>
<tr>
<td>Age &gt;80 years</td>
<td>265</td>
<td>19.7</td>
</tr>
<tr>
<td>Recent MI</td>
<td>174</td>
<td>13.0</td>
</tr>
<tr>
<td>Unstable angina</td>
<td>1</td>
<td>0.0</td>
</tr>
<tr>
<td>CHF class III or IV</td>
<td>125</td>
<td>9.3</td>
</tr>
<tr>
<td>LVEF &lt;30%</td>
<td>35</td>
<td>2.6</td>
</tr>
<tr>
<td>Hemodialysis</td>
<td>108</td>
<td>8.0</td>
</tr>
<tr>
<td>Severe pulmonary disease*a</td>
<td>250</td>
<td>18.6</td>
</tr>
<tr>
<td>CABG/valve repair within 30 days</td>
<td>32</td>
<td>2.4</td>
</tr>
<tr>
<td>Anatomic high risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contralateral ICA occlusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restenosis after CEA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior neck surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contralateral laryngeal nerve pals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>History of neck irradiation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High or low lesion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perioperative stroke</td>
<td>26</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Table V. Comparison of outcomes analysis using NSQIP data and physician chart review in 392 patients who underwent CEA between 2005 and 2011

<table>
<thead>
<tr>
<th></th>
<th>NSQIP data</th>
<th>Physician chart review</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Symptomatic</td>
<td>173</td>
<td>44.1</td>
</tr>
<tr>
<td>Physiologic high risk</td>
<td>51</td>
<td>13.0</td>
</tr>
<tr>
<td>Age &gt;80 years</td>
<td>76</td>
<td>19.4</td>
</tr>
<tr>
<td>Recent MI</td>
<td>7</td>
<td>1.8</td>
</tr>
<tr>
<td>Unstable angina</td>
<td>8</td>
<td>2.0</td>
</tr>
<tr>
<td>CHF class III or IV</td>
<td>3</td>
<td>0.8</td>
</tr>
<tr>
<td>LVEF &lt;30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemodialysis</td>
<td>3</td>
<td>0.8</td>
</tr>
<tr>
<td>Severe pulmonary disease*a</td>
<td>41</td>
<td>10.4</td>
</tr>
<tr>
<td>CABG/valve repair within 30 days</td>
<td>3</td>
<td>0.8</td>
</tr>
<tr>
<td>Anatomic high risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contralateral ICA occlusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restenosis after CEA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior neck surgery</td>
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</tr>
<tr>
<td>Contralateral laryngeal nerve pals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>History of neck irradiation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High or low lesion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perioperative stroke</td>
<td>6</td>
<td>1.5</td>
</tr>
</tbody>
</table>

CABG, Coronary artery bypass grafting; CEA, carotid endarterectomy; CHF, congestive heart failure; ICA, internal carotid artery; LVEF, left ventricular ejection fraction; MI, myocardial infarction; NSQIP, National Surgical Quality Improvement Program.

*aForced expiratory volume in 1 second <30% of predicted or home oxygen.

Discrepancy of data raises concern.

emoryhealthcare.org/vascular

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### SAVS ABSTRACT - UVA

- Comparing outcomes for LEB VQI vs NSQIP

#### Table. Unadjusted and adjusted outcomes of infrainguinal bypass in VQI and NSQIP registries

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Unadjusted</th>
<th>Propensity-matched</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NSQIP unmatched</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(n = 4007, No. (%))</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unadjusted</th>
<th>Propensity-matched</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSQIP (n = 5273), No. (%)</td>
<td>VQI (n = 1368), No. (%)</td>
</tr>
</tbody>
</table>

- 30-day mortality: 93/5273 (1.8) vs 27/1388 (2.0) | P = .6
- Any MI or stroke: 171/5272 (3.2) vs 53/1388 (3.9) | P = .2
- Return to OR bleeding: 847/5272 (16) vs 156/1384 (12) | P < .001
- Major amputation: 101/5273 (3.3) vs 22/1355 (1.6) | P = .002
- Wound infection: 674/5272 (13) vs 19/1356 (1.4) | P < .001

#### Notes:

- P value given for the comparison between matched groups.
- Represents a statistically significant difference (P < .05) from the NSQIP-matched group.
WAYS TO IMPROVE DATA ENTRY

• Point of Care (POC) data entry
  – Have H&P mirror data points needed
  – Operative notes
  – Discharge summaries
  – Outpatient visit

• COMMUNICATION!!!
FAILURE TO COMMUNICATE
WAYS TO IMPROVE COMMUNICATION

• Proximity to point of care
• NOT more email
• NOT more pages
• Being present at time of care
LOCATION, LOCATION, LOCATION

- Proximity to POC
- Rounding with team
- Attendance at conferences
- Presence in outpatient clinic
Aligning the Data

IMPROVING DATA COLLECTION

• Providing ease of data entry into regular workflow

• Reviewing abnormal findings

• Checking outliers
VQI FORMS IN EPIC SYSTEM

- Choose template from list of options
- Must have knowledge of the local EMR
VQI FORMS IN EMR

- Completed at time of surgery/event
- Still requires regular data review
Aligning the Data

**VQI CAS DISCHARGE**

- Queries the datapoints of VQI
- Requires attention of discharging provider
PROCESS THE INFORMATION

Industry reports suggest that more than 60% of company data sources contain data quality concerns.
HOW TO ALIGN DATA COLLECTION WITH PROVIDERS

- Recognize the importance of accurate information
- Ease the collection of data into regular workflow
- Perform regular evaluation of information
Aligning the Data

THANK YOU

emoryhealthcare.org/vascular
Smoking Cessation Counseling Videos

- Ineffective Counseling:
  - https://www.youtube.com/watch?v=80XyN E89eCs

- Effective Counseling:
  - https://www.youtube.com/watch?v=URiKA 7CKtfc
SEVSG Ongoing Regional QI
Adam Beck

How are we doing?
- Little Goal: Statin/AP at Discharge
- Big Goal: Smoking Cessation
Effect of Discharge Medications on Survival

81% Both
75% AP
68% Statin
55% None

P<0.001 SE < 0.1

26% Absolute improvement in 5-year survival when patients are discharged on AP & Statin

Discharge Medications Antiplatelet and Statin (2015)
Excludes missing, not treated for medical reason and non-compliant

A+S Rate by Center in Your Region (2015)

A+S Rate by Region across VQI (2015)

* Indicates region’s rate is significantly different than overall VQI rate
"Others" indicates centers that do not belong to a regional group
Statin/AP QI at U. of Fl
PCP Letter Risk Factor Modification

Vascular Quality Initiative

College of Medicine
Department of Surgery
Division of Vascular Surgery and Endovascular Therapy

Health Science Center
PO Box 100128
Gainesville, FL 32610
(352) 273-5484 phone
(352) 273-5515 fax

Date: __________________________

Dear __________________________,

We had the pleasure of seeing __________________________ in our office recently in consultation. He/she has a history of Peripheral Vascular Disease (PVD). As you know, PVD is linked to other adverse cardiovascular events, and there are a number of risk factor modification measures that have been demonstrated by a growing body of literature to improve the long-term outcomes of these patients.

Our group is an active participant in The Society for Vascular Surgery’s Vascular Quality Initiative (SVS: VQI), which actively promotes risk factor modification measures including such things as smoking cessation, exercise regimens, statin therapy, anti-platelet therapy, and control of hypertension, in patients undergoing vascular procedures.

In preparation for a vascular intervention, we may have started new medications on our mutual patient, and we wanted to make sure that you are aware. If he/she has been started on a new medication, and you have no objections, please make arrangements for the appropriate clinical follow-up, which we would like to defer to you as the primary provider.

New medications started (circled):

1. Statin
2. ACE Inhibitor/AI
3. Anti-platelet therapy

Thank you very much for your consideration and continued care of our shared patient. Please do not hesitate to contact our office at 352-273-5484 if you have any questions.

Sincerely,

---

Patient Letter

College of Medicine  
Department of Surgery  
Division of Vascular Surgery and Endovascular Therapy

Date: ____________________________

Dear _________________________,

As you may recall from your most recent appointment with us, we have started you on a new medication called Simvastatin (you may also be familiar with its Brand name, Zocor). Simvastatin is part of a class of medications called statins, which have proven effective in reducing the risk of stroke, heart attack, and death in patients with Peripheral Arterial Disease (PAD), carotid artery disease, and aneurysmal disease.1-3

You have two types of cholesterol in your body, HDL, the “good” cholesterol, and LDL, the “bad” cholesterol. Statins work by lowering your LDL cholesterol. When your LDL cholesterol gets too high, it can create build-ups in your blood vessels, called atherosclerotic plaques. Statins help to prevent the formation of these plaques and stabilize the ones that have already formed, so that they are less likely to break apart and cause heart attacks and/or strokes. Thus, even people with PAD who have a normal LDL cholesterol level will benefit from taking a statin.

Simvastatin, like all other medications, may have some side effects. A small number of patients have experienced minor changes in liver function. If at any time during your statin therapy you develop severe muscle aches, unusual fatigue or weakness, loss of appetite, upper belly pain, dark-colored urine, or yellowing of the skin or the whites of the eyes, it is important to notify your surgeon or PCP in a timely fashion as any of these side effects could be a sign of decreased liver function.3

Although rare, some patients have reported brain-related side effects including memory loss and confusion, while others have reported increases in blood sugar levels and being diagnosed with type 2 diabetes mellitus, a disease that occurs when the body is not able to use sugar as it should. It is important to notify your PCP should you experience any of these side effects.

If you have further questions, please do not hesitate to contact our office at (352) 273-5484, and we will be happy to speak with you.

Sincerely,

EPIC Discharge Summary Template

Hospital Course: ***
Total # PRBC transfused: ***
# days in the ICU: ***
Admit creatinine: ***
Discharge creatinine: ***

Significant Diagnostic Studies: (diagnostics:18242)

Treatments: (Tx:18249)

Disposition: (condition:18249:****)
Discharged Condition: (condition:18240:****)

Discharge Medications:
You have not been prescribed any medications.

No discharge procedures on file:
If a statin is not in the discharge medications, please provide a reason: [SHIP VASCULAR SURGERY D/C SUMMARY-STATIN:304210333]
If a beta-blocker is not in the discharge medications, please provide a reason: [SHIP VASCULAR SURGERY D/C SUMMARY-BETA BLOCKER:304210393]
If Aspirin or Plavix (or an equivalent anti-platelet agent) is not in the discharge medications: [SHIP VASCULAR SURGERY D/C SUMMARY-ANTI PLATELET-AGENT:304210393]

Discharge Instructions: ***
Symptoms to Report to Your Doctor: Temperature 101, pain uncontrolled by medication, drainage or foul odor from incision, extensive bruising or discoloration, chest pain, shortness of breath, nausea, vomiting and

8:42 AM
### TEVAR STATIN THERAPY (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>My Center Results</th>
<th>All Other Regional Participants</th>
<th>All Other National Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012 (N=95/5/591)</td>
<td>80.0%</td>
<td>0.0%</td>
<td>64.1%</td>
</tr>
<tr>
<td>2013 (N=127/14/836)</td>
<td>88.2%</td>
<td>64.3%</td>
<td>66.9%</td>
</tr>
<tr>
<td>2014 (N=118/26/1476)</td>
<td>97.5%</td>
<td>42.3%</td>
<td>65.0%</td>
</tr>
<tr>
<td>2015 (N=107/27/1475)</td>
<td>100.0%</td>
<td>48.1%</td>
<td>67.0%</td>
</tr>
</tbody>
</table>

### OAAA STATIN THERAPY (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>My Center Results</th>
<th>All Other Regional Participants</th>
<th>All Other National Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012 (N=38/39/856)</td>
<td>94.7%</td>
<td>64.1%</td>
<td>73.1%</td>
</tr>
<tr>
<td>2013 (N=45/40/1214)</td>
<td>86.7%</td>
<td>57.5%</td>
<td>72.2%</td>
</tr>
<tr>
<td>2014 (N=47/50/1523)</td>
<td>93.6%</td>
<td>66.0%</td>
<td>73.9%</td>
</tr>
<tr>
<td>2015 (N=39/44/1288)</td>
<td>100.0%</td>
<td>72.7%</td>
<td>75.9%</td>
</tr>
</tbody>
</table>
**EVAR STATIN THERAPY (%)**

<table>
<thead>
<tr>
<th>Year</th>
<th>My Center Results</th>
<th>All Other Regional Participants</th>
<th>All Other National Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012 (N=40/156/3393)</td>
<td>85.0%</td>
<td>71.2%</td>
<td>73.7%</td>
</tr>
<tr>
<td>2013 (N=38/243/4660)</td>
<td>89.5%</td>
<td>61.3%</td>
<td>73.5%</td>
</tr>
<tr>
<td>2014 (N=34/371/5932)</td>
<td>97.1%</td>
<td>70.4%</td>
<td>75.3%</td>
</tr>
<tr>
<td>2015 (N=22/393/5507)</td>
<td>100.0%</td>
<td>74.6%</td>
<td>77.9%</td>
</tr>
</tbody>
</table>

**PVI STATIN THERAPY (%)**

<table>
<thead>
<tr>
<th>Year</th>
<th>My Center Results</th>
<th>All Other Regional Participants</th>
<th>All Other National Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012 (N=109/150/11141)</td>
<td>79.8%</td>
<td>63.3%</td>
<td>73.8%</td>
</tr>
<tr>
<td>2013 (N=103/180/15496)</td>
<td>77.7%</td>
<td>67.2%</td>
<td>74.2%</td>
</tr>
<tr>
<td>2014 (N=133/1089/22720)</td>
<td>94.0%</td>
<td>75.5%</td>
<td>74.4%</td>
</tr>
<tr>
<td>2015 (N=81/1696/21918)</td>
<td>100.0%</td>
<td>74.9%</td>
<td>77.0%</td>
</tr>
</tbody>
</table>
### Infra-Inguinal Bypass STATIN THERAPY (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>My Center Results</th>
<th>All Other Regional Participants</th>
<th>All Other National Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>96.4%</td>
<td>65.8%</td>
<td>78.2%</td>
</tr>
<tr>
<td>2013</td>
<td>90.4%</td>
<td>72.1%</td>
<td>78.3%</td>
</tr>
<tr>
<td>2014</td>
<td>100.0%</td>
<td>75.7%</td>
<td>79.1%</td>
</tr>
<tr>
<td>2015</td>
<td>100.0%</td>
<td>71.6%</td>
<td>79.5%</td>
</tr>
</tbody>
</table>

### Supra-Inguinal Bypass STATIN THERAPY (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>My Center Results</th>
<th>All Other Regional Participants</th>
<th>All Other National Participants</th>
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</thead>
<tbody>
<tr>
<td>2012</td>
<td>96.1%</td>
<td>67.2%</td>
<td>76.2%</td>
</tr>
<tr>
<td>2013</td>
<td>90.9%</td>
<td>64.5%</td>
<td>77.3%</td>
</tr>
<tr>
<td>2014</td>
<td>100.0%</td>
<td>68.9%</td>
<td>78.0%</td>
</tr>
<tr>
<td>2015</td>
<td>100.0%</td>
<td>70.6%</td>
<td>80.9%</td>
</tr>
</tbody>
</table>
SEVSG Smoking Cessation
SEVSG Reported Smoking Cessation (%) 2013 VS 2015

<table>
<thead>
<tr>
<th>Procedure</th>
<th>2013 Reported Cessation Rate</th>
<th>2015 Reported Cessation Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS</td>
<td>9% (N=33/132)</td>
<td>23% (N=234/821)</td>
</tr>
<tr>
<td>CEA</td>
<td>13% (N=92/353)</td>
<td>21% (N=64/145)</td>
</tr>
<tr>
<td>EVAR</td>
<td>9% (N=157/487)</td>
<td>18% (N=203/766)</td>
</tr>
<tr>
<td>INFRA</td>
<td>15% (N=64/145)</td>
<td>24% (N=80/287)</td>
</tr>
<tr>
<td>OAAA</td>
<td>22% (N=157/487)</td>
<td>29% (N=203/766)</td>
</tr>
<tr>
<td>PVI</td>
<td>17% (N=64/145)</td>
<td>21% (N=80/287)</td>
</tr>
<tr>
<td>SUPRA</td>
<td>24% (N=234/821)</td>
<td>25% (N=203/766)</td>
</tr>
<tr>
<td>TOTAL PROCEDURES</td>
<td>15%</td>
<td>22%</td>
</tr>
</tbody>
</table>
Implementation and Outcomes of a Smoking Cessation Program at the U. of Florida
• Smoking is a known risk factor for coronary atherosclerosis
  – Twice as likely to cause PAD than CAD\textsuperscript{4}
• Cessation may reduce the risk of PAD development
  – Continued smoking worsens clinical PAD\textsuperscript{7}
Smoking cessation is associated with decreased mortality and improved amputation-free survival among patients with symptomatic peripheral artery disease.

Ehrin J. Armstrong, MD, MS, Julie Wu, BS, Gagan D. Singh, MD, David L. Dawson, MD, William C. Pevec, MD, Ezra A. Amsterdam, MD, and John R. Laird, MD. Aurora, Colo; and Sacramento, Calif.
Fig 1. Kaplan-Meier curves show (A) mortality, (B) rates of major amputation, and (C) amputation-free survival among patients who continued (solid line) vs quit (dashed line) smoking.
Mortality benefit may surpass benefit of elective aneurysm repair or carotid endarterectomy.

Limb preservation benefit may surpass benefit of bypass or PVI.

Vascular Specialists are in a unique position.
“A brief advice intervention can increase smoking cessation by a further 1 to 3% with only a small effect of additional components. Intensive intervention provides only a small additional benefit.”
Endpoints

- Successful Implementation?
- Does a smoking cessation protocol work?
  - Success: 1 month abstinence from smoking
COUNSELING PROTOCOL

• Engage in an empathetic discussion ("I know it’s easy for me to say, and hard for you to do...")
• Assess willingness to quit
• Assist
  – Pharmacologic Therapy
  – Nicotine Replacement Therapy (NRT)
  – Provide a plan: “Quit date”
  – AHEC
• Documentation! (EMR, VQI and Divisional Database)
Methods/Results

Methods/Results

Prospectively screened from 8/2013 to 3/2016

399 Active Smokers

Offered Counseling

378 Active Smokers

431x374 Offered Counseling

497x266 Accepted

299 Accepted

104 Quit (10m)

117 Quit (>1 m)

79 Refused

182 Resumed (<1 m)

11m mean follow-up

79 Refused

87 Reduced usage

QUIT RATE: 31% (vs. 15% p < 0.01)

RECIDIVISM: 60%

REDUCTION RATE: 29%
## Does Procedure Type Influence Quit Rate?

<table>
<thead>
<tr>
<th>Proc Type</th>
<th># of Proc</th>
<th>Refusal Rate</th>
<th>Quit Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotid Endarterectomy</td>
<td>28</td>
<td>29% (8)</td>
<td>21% (6)</td>
</tr>
<tr>
<td>Endo AAA Repair</td>
<td>20</td>
<td>35% (7)</td>
<td>10% (2)</td>
</tr>
<tr>
<td>Hemodialysis Access</td>
<td>30</td>
<td>17% (5)</td>
<td>27% (8)</td>
</tr>
<tr>
<td>IVC Filter</td>
<td>12</td>
<td>8% (1)</td>
<td>50% (6)</td>
</tr>
<tr>
<td>Infra-inguinal Bypass</td>
<td>33</td>
<td>15% (5)</td>
<td>45% (15)</td>
</tr>
<tr>
<td>Open AAA Repair</td>
<td>31</td>
<td>26% (8)</td>
<td>39% (12)</td>
</tr>
<tr>
<td>Peripheral Vascular</td>
<td>90</td>
<td>19% (17)</td>
<td>27% (24)</td>
</tr>
<tr>
<td>Intervention</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supra-inguinal Bypass</td>
<td>49</td>
<td>18% (9)</td>
<td>33% (16)</td>
</tr>
<tr>
<td>Thoracic and Complex EVAR</td>
<td>55</td>
<td>11% (6)</td>
<td>38% (21)</td>
</tr>
<tr>
<td>Not in VQI</td>
<td>28</td>
<td>46% (13)</td>
<td>25% (7)</td>
</tr>
<tr>
<td>Total</td>
<td>378</td>
<td>21% (79)</td>
<td>31% (117)</td>
</tr>
</tbody>
</table>
What Other Factors Influence Quitting?

<table>
<thead>
<tr>
<th>SIGNIFICANT</th>
<th>P-value</th>
<th>NOT SIGNIFICANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAD + Gender (M)-quit Procedure @ UF</td>
<td>0.046*</td>
<td>0.001*</td>
</tr>
<tr>
<td></td>
<td>0.930</td>
<td>Gender</td>
</tr>
<tr>
<td></td>
<td>0.771</td>
<td>Practitioner (Initial intervention)</td>
</tr>
<tr>
<td></td>
<td>0.273</td>
<td>AAA ENDO VS OPEN</td>
</tr>
<tr>
<td></td>
<td>0.423</td>
<td>AAA MULTI PROC</td>
</tr>
<tr>
<td></td>
<td>0.831</td>
<td>PAD VS OTHER</td>
</tr>
<tr>
<td></td>
<td>0.694</td>
<td>PAD MULTI PROC</td>
</tr>
<tr>
<td></td>
<td>0.457</td>
<td>AAA + Gender</td>
</tr>
<tr>
<td></td>
<td>0.587</td>
<td>PAD VS OTHER</td>
</tr>
</tbody>
</table>
• Difficult to define “smoking cessation”
  – Short time interval (one month)
  – Frequent recidivism
  – Average successful “quitter” takes 7 attempts

• Retrospective Data

• Small patient cohort
• A *simple* smoking cessation protocol can be uniformly accepted within a busy practice and implemented by all providers

• Patients are often receptive to the discussion, and do successfully quit more often

• Successful smoking cessation rate remains frustratingly low, and there is more work to be done.
Data Abstractor Breakout

- Perioperative moderate hypothermia in vascular surgery
  - Bill Ashwander, MD, Emory
- Perioperative hyperglycemia in vascular surgery patients
  - Chandler Long, MD, Emory
- Identifying frailty in vascular surgery patients
  - Shipra Arya, MD, Emory
All Attendees

• Using VQI data to implement change: CEA LOS improvement
  – Yazan Duwayri, MD, Emory

• How we use the VQI for quality improvement
  – Chuck Thompson, MD, Orlando Regional
Extended Meeting Suggestion

Next Meeting Location and Date

Goals before next Meeting
- Little Goal?
  -(Statin/AP Therapy)
- Big Goal?
  -(Smoking Cessation)
- Center Recruitment
Please Complete the online survey After Meeting

- [https://www.surveymonkey.com/r/6SDLLCB3](https://www.surveymonkey.com/r/6SDLLCB3)
One Platform. One Data Set. Many Stakeholders.

VQI Registry Stakeholders

- Hospitals
- Research Projects
- FDA
- CMS & Other Payers
- NIH NINDS
- NIH
- NINDS
- Device Companies
- EHR Companies
- Physicians
- Inter-National Registries
- Patients

SVS PSO

M2S
Identifying Frailty In Vascular Surgery Patients

Shipra Arya MD SM
Assistant Professor of Surgery- Vascular Surgery
Emory University School of Medicine
Atlanta VA Medical Center, Decatur GA
No pertinent financial disclosures
Frailty

• A medical syndrome
  – with multiple causes and contributors
  – characterized by diminished strength, endurance, and reduced physiologic function
  – increases an individual’s vulnerability for developing increased dependency and/or death
  – Domains: physical, functional, cognitive, nutritional, social

J.E. Morley et al. / JAMDA 14 (2013) 392e397
Frailty and stressor

Figure 1: Frailty as Measure of Physiologic Reserve

- Physiologic Reserve
- Available Physiologic Reserve
- Expended Physiologic Reserve
- Stress of Surgery
- Death
- Frail
- Average
- Robust

Age in Years

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

SEVSG May 2016
Fried Frailty Phenotype

• Developed using data from the Cardiovascular Health Study (CHS)
• Validated in the Women's Health and Aging Studies (WHAS) as well
• Predictive of falls, hospitalizations, ADL disability, and death in community-dwelling older adults.
# Appendix 1. Frailty Data Collected

<table>
<thead>
<tr>
<th>Hopkins Frailty Score</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrinking</td>
<td>Self-reported unintentional weight loss $\geq 10$ lbs in the last year.</td>
</tr>
<tr>
<td>Weakness</td>
<td>Measured by having the patient squeeze a hand-held JAMAR dynamometer. Three serial tests of maximum grip strength with the dominant hand were performed, and a mean of the 3 values was adjusted by sex and body mass index (BMI). Men met the criteria for weakness if their BMI and grip strength were $\leq 24$ kg/m$^2$ and $\leq 29$ kg of force; 24.1-26 and $\leq 30$ kg; 26.1-28 and $\leq 31$ kg; $&gt; 28$ and $\leq 32$ kg, respectively. Women met the criteria for weakness if their BMI and grip strength were $\leq 23$ kg/m$^2$ and $\leq 17$ kg; 23.1-26 and $\leq 17.3$ kg; 26.1-29 and $\leq 18$, and $&gt; 29$ and $\leq 21$ kg, respectively.</td>
</tr>
<tr>
<td>Exhaustion</td>
<td>Measured by responses to questions about effort and motivation. The following 2 statements were used from the modified 10-item Center for Epidemiological Studies-Depression scale: “I felt that everything I did was an effort” and “I could not get going.” Subjects were asked, “How often in the last week did you feel this way?” Potential responses were: 0 = rarely or none of the time (&lt;1 day); 1 = some or little of the time (1-2 days); 2 = a moderate amount of the time (3-4 days); and 3 = most of the time. Subjects answering either statement with a response of 2 or 3 met the criteria for exhaustion.</td>
</tr>
<tr>
<td>Low activity</td>
<td>Determined by inquiring about leisure time activities. Physical activities were ascertained for the previous 2 weeks using the short version of the Minnesota Leisure Time Activities Questionnaire, and included frequency and duration. Weekly tasks were converted to equivalent kilocalories of expenditure, and individuals reporting a weekly kilocalorie expenditure below the following criteria were classified as having low physical activity: men, $&lt; 383$ kcal/week; women, $&lt; 270$ kcal/week.</td>
</tr>
<tr>
<td>Slowed walking speed</td>
<td>Measured by the speed at which a patient walks 15 feet. The final time was taken by averaging 3 trials of walking the 15 feet at a normal pace. Men met the slowness criteria if height and walk time were $\leq 173$ cm and $\geq 7$ seconds, or $&gt; 173$ cm and $\geq 6$ seconds, respectively. Women met criteria if height and walk time were $\leq 159$ cm and $\geq 7$ seconds, or $&gt; 159$ cm and $\geq 6$ seconds, respectively.</td>
</tr>
</tbody>
</table>
CSHA Frailty Index

- Canadian Study of Health and Aging
- 70 point scale
- Rockwood and colleagues developed a frailty index (FI) as a measure of deficit accumulation, that is, a measure of the cumulative burden of, for example, symptoms, diseases, conditions, and disability.
### Appendix 1: List of variables used by the Canadian Study of Health and Aging to construct the 70-item CSHA Frailty Index

- Changes in everyday activities
- Head and neck problems
- Poor muscle tone in neck
- Bradykinesia, facial
- Problems getting dressed
- Problems with bathing
- Problems carrying out personal grooming
- Urinary incontinence
- Toileting problems
- Bulk difficulties
- Rectal problems
- Gastrointestinal problems
- Problems cooking
- Sucking problems
- Problems going out alone
- Impaired mobility
- Musculoskeletal problems
- Bradykinesia of the limbs
- Poor muscle tone in limbs
- Poor limb coordination
- Poor coordination, trunk
- Poor standing posture
- Irregular gait pattern
- Falls
- Mood problems
- Feeling sad, blue, depressed
- History of depressed mood
- Tiredness all the time
- Depression (clinical impression)
- Sleep changes
- Restlessness
- Memory changes
- Short-term memory impairment
- Long-term memory impairment
- Changes in general mental functioning
- Onset of cognitive symptoms
- Clouding or delirium
- Paranoid features
- History relevant to cognitive impairment or loss
- Family history relevant to cognitive impairment or loss
- Impaired vibration
- Tremor at rest
- Postural tremor
- Intention tremor
- History of Parkinson’s disease
- Family history of degenerative disease
- Seizures, partial complex
- Seizures, generalized
- Syncope or blackouts
- Headache
- Cerebrovascular problems
- History of stroke
- History of diabetes mellitus
- Arterial hypertension
- Peripheral pulses
- Cardiac problems
- Myocardial infarction
- Arrhythmia
- Congestive heart failure
- Lung problems
- Respiratory problems
- History of thyroid disease
- Thyroid problems
- Skin problems
- Malignant disease
- Breast problems
- Abdominal problems
- Presence of snout reflex
- Presence of the palomental reflex
- Other medical history
• Rockwood et al previously found that any 10-15 items on the CSHA-FI have a similar predictive value for frailty.

• The phenotypic definition of frailty, which offers ready clinical operationalization, discriminates broad levels of risk.
<table>
<thead>
<tr>
<th>CSHA-FI</th>
<th>NSQIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes in everyday activity</td>
<td>Functional health status prior to surgery—partially</td>
</tr>
<tr>
<td>Problems with getting dressed</td>
<td>dependent</td>
</tr>
<tr>
<td>Problems with bathing</td>
<td>Functional health status prior to surgery—totally</td>
</tr>
<tr>
<td>Problems with carrying out personal grooming</td>
<td>dependent</td>
</tr>
<tr>
<td>Problems cooking</td>
<td></td>
</tr>
<tr>
<td>Problems going out alone</td>
<td>Diabetes mellitus, non–insulin-dependent</td>
</tr>
<tr>
<td>History of diabetes mellitus</td>
<td>Diabetes mellitus, insulin-dependent</td>
</tr>
<tr>
<td>Lung problems</td>
<td></td>
</tr>
<tr>
<td>Respiratory problems</td>
<td></td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>History of severe COPD</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>Current pneumonia</td>
</tr>
<tr>
<td>Cardiac problems</td>
<td></td>
</tr>
<tr>
<td>Arterial hypertension</td>
<td>Previous percutaneous coronary intervention/percutaneous</td>
</tr>
<tr>
<td>Clouding or delirium</td>
<td>Previous cardiac surgery</td>
</tr>
<tr>
<td>History relevant to cognitive impairment or</td>
<td></td>
</tr>
<tr>
<td>loss</td>
<td>History of angina within 1 month prior to surgery</td>
</tr>
<tr>
<td>Family history relevant to cognitive impairment</td>
<td></td>
</tr>
<tr>
<td>Cerebrovascular problems</td>
<td>History of transient ischemic attack</td>
</tr>
<tr>
<td>History of stroke</td>
<td>Cerebrovascular accident/stroke with neurological deficit</td>
</tr>
<tr>
<td>Decreased peripheral pulses</td>
<td>History of revascularization/amputation for peripheral</td>
</tr>
<tr>
<td></td>
<td>vascular disease</td>
</tr>
<tr>
<td></td>
<td>Rest pain/gangrene</td>
</tr>
</tbody>
</table>
Frailty increases the risk of 30-day mortality, morbidity, and failure to rescue after elective abdominal aortic aneurysm repair independent of age and comorbidities

- 23,207 patients, NSQIP database
- Adjusted mortality odds ratio: OR 1.9 (95% CI, 1.2-3.0) after endovascular and 2.3 (95% CI, 1.4-3.7) after open repair
- Clavien-Dindo class IV complications after EVAR (OR 1.7; 95% CI, 1.3-2.1) and OAR (OR 1.8; 95%, CI, 1.5-2.1).
- There was also a higher FTR rate among frail patients, with OR 1.7 (95% CI, 1.2-2.5)
Frailty and unplanned readmission in PAD

Unplanned readmissions (%)

Increasing level of frailty

P<0.05

Unplanned readmissions:

- 0: 7.55%
- 0.9: 10.16%
- 0.18: 12.16%
- 0.27: 15.43%
- 0.36: 18.87%
- 0.45: 20.7%
- 0.54: 25.32%
- 0.63+: 25%

5/16/2016
Preoperative Frailty Increases Risk of Non-Home Discharge After Elective Vascular Surgery In Home-Dwelling Patients

Shipra Arya,1 Chandler Long,1 Reshma Brahmbhatt,1 Susan Shafii,1 Luke P. Brewster,1 Ravi Veeraswamy,1 Theodore M. Johnson II,1 and Jason M. Johanning,2

1Emory University, Atlanta, GA. 2University of Nebraska Medical Center, Omaha, NE.

Table 3. Occurrence of non-home discharge (DC), stratified by diagnosis, procedure type and frailty [n (% of total)]. Unadjusted Odds Ratio (OR) of non-home DC in frail as compared to non-frail patients

<table>
<thead>
<tr>
<th>Procedure</th>
<th>N</th>
<th>Non-home DC (%)</th>
<th>Prevalence Frailty (%)</th>
<th>Non-home DC Frail</th>
<th>Non-home DC Non-frail</th>
<th>Unadjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>2402</td>
<td>145 (6.0%)</td>
<td>542 (22.6%)</td>
<td>43 (7.9%)</td>
<td>102 (5.5%)*</td>
<td>1.5 (1.0-2.1)</td>
</tr>
<tr>
<td>EVAR</td>
<td>729</td>
<td>139 (19.1%)</td>
<td>150 (20.6%)</td>
<td>48 (32.0%)</td>
<td>91 (15.7%)*</td>
<td>2.5 (1.7-3.8)</td>
</tr>
<tr>
<td>Open AAA repair</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Peripheral arterial disease</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infra-inguinal bypass</td>
<td>3113</td>
<td>500 (16.1%)</td>
<td>1532 (49.2%)</td>
<td>331 (21.6%)</td>
<td>169 (10.7%)*</td>
<td>2.3 (1.9-2.8)</td>
</tr>
<tr>
<td>Supra-inguinal bypass</td>
<td>1326</td>
<td>158 (11.9%)</td>
<td>498 (37.6%)</td>
<td>93 (18.7%)</td>
<td>65 (7.9%)*</td>
<td>2.7 (1.9-3.8)</td>
</tr>
<tr>
<td>Peripheral EV interventions</td>
<td>2222</td>
<td>73 (3.3%)</td>
<td>961 (43.3%)</td>
<td>44 (4.6%)</td>
<td>29 (2.3%)*</td>
<td>2.0 (1.3-3.3)</td>
</tr>
<tr>
<td><em>Carotid artery stenosis</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carotid stenting</td>
<td>118</td>
<td>2 (1.7%)</td>
<td>47 (39.8%)</td>
<td>2 (4.3%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>CEA</td>
<td>5933</td>
<td>160 (2.7%)</td>
<td>2184 (36.8%)</td>
<td>98 (4.5%)</td>
<td>62 (1.7%)*</td>
<td>2.8 (2.0-3.9)</td>
</tr>
<tr>
<td>Total</td>
<td>15843</td>
<td>1177 (7.4%)</td>
<td>5933 (37.5%)</td>
<td>659 (11.1%)</td>
<td>518 (5.2%)*</td>
<td>2.3 (2.0-2.6)</td>
</tr>
</tbody>
</table>

* p<0.05 for each procedure type comparing non-home DC risk in frail patients to non-frail

CI: confidence interval; AAA: Abdominal aortic aneurysm; EVAR: Endovascular aortic aneurysm repair; EV: endovascular; CEA: Carotid endarterectomy
Non-home Discharge (DC) stratified by Frailty and Occurrence of Complications

- Frail + Complications: 27.5%
- Nonfrail + Complications: 16.5%
- Frail + No Complications: 5.5%
- Nonfrail + No Complications: 2.75%
Gender and frailty predict poor outcomes in infrainguinal vascular surgery

Reshma Brahmbhatt, MD, Luke P. Brewster, MD, PhD, Susan Shafii, MD, Ravi R. Rajani, MD, Ravi Veeraswamy, MD, Atef Salam, MD, Thomas F. Dodson, MD, and Shipra Arya, MD, SM

Division of Vascular Surgery and Endovascular Therapy, Emory University School of Medicine, Atlanta, Georgia
Surgical Service Line, Atlanta VA Medical Center, Decatur, Georgia

Fig. 2 — Effect of frailty and gender on adjusted (A) 30-d mortality and (B) 30-d morbidity (on multivariate regression modeling). (Color version of figure is available online.)
The MDS Mortality Risk Index: The evolution of a method for predicting 6-month mortality in nursing home residents

Davina Porock*1,2,3, Debra Parker-Oliver4, Gregory F Petroski5 and Marilyn Rantz6

• MMRI
  – Predict 6 month mortality at time of admission to nursing home (e.g., those who qualify for palliative care consultation)
  – 12 questions, single page
  – Developed and validated in subsamples of the Minimum Data Set (MDS), a large database mandated for use in all US nursing homes
  – ROC area was 0.76
Risk Analysis Index (RAI)

- Based on 11/12 MMRI items
- Applied to VASQIP and NSQIP data
- Prospectively administered preoperatively to over 10,000 patients at Omaha VA since 2011.
- Administered by nurses in ~2 minutes.
- Mortality and Complications increase dramatically when RAI > 21.
- ROC area was 0.78
Preoperative frailty Risk Analysis Index to stratify patients undergoing carotid endarterectomy

Screen all electively scheduled patients for frailty beginning August 2011

Conduct administrative review of all frail patients:
- Call operating surgeon to discuss frailty diagnosis and predicted mortality
- Alert anesthesia and critical care to frail status
- Aggressive referral for preoperative palliative care consultation
Table 1: Change in mortality at different time horizons before and after implementing the FSI, 2007-2014

<table>
<thead>
<tr>
<th></th>
<th>30-Day Mortality</th>
<th>180-Day Mortality</th>
<th>360-Day Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N %</td>
<td>N %</td>
<td>N %</td>
</tr>
<tr>
<td>Before FSI</td>
<td>84 1.6%</td>
<td>223 4.2%</td>
<td>317 6.0%</td>
</tr>
<tr>
<td>After FSI</td>
<td>26 0.7%</td>
<td>38 1.1%</td>
<td>37 1.4%</td>
</tr>
<tr>
<td>Total</td>
<td>110 1.2%</td>
<td>261 3.0%</td>
<td>354 4.4%</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Frail</td>
<td>60 1.2%</td>
<td>176 3.5%</td>
<td>249 4.9%</td>
</tr>
<tr>
<td></td>
<td>15 0.4%</td>
<td>21 0.7%</td>
<td>20 0.8%</td>
</tr>
<tr>
<td></td>
<td>75 0.9%</td>
<td>197 2.4%</td>
<td>269 3.6%</td>
</tr>
<tr>
<td>Frail</td>
<td>24 12.2%</td>
<td>47 23.9%</td>
<td>68 39.9%</td>
</tr>
<tr>
<td></td>
<td>11 2.7%</td>
<td>17 4.5%</td>
<td>17 5.7%</td>
</tr>
<tr>
<td></td>
<td>35 5.8%</td>
<td>64 11.1%</td>
<td>85 17.2%</td>
</tr>
<tr>
<td>Total N</td>
<td>5275</td>
<td>5275</td>
<td>7984</td>
</tr>
</tbody>
</table>

Differences between mortality before and after implementing the FSI were tested using Pearson Correlation. Differences were significant at every time horizon, and in every group (frail, non frail, and overall) at levels of p<.001. At 30 days, 6.7% (n=603) were frail. At 180 days, 6.7% (n=578) of the sample was frail. At 360 days 6.2% (n=494) were frail.

- Multivariate models controlling for age and frailty demonstrate the odds of 180-day survival increased after implementing FSI (OR 3.360, 95% CI 1.776-6.359), and the increase was greatest among the frail (OR 7.503, 95% CI 4.081-13.795).
Omaha Frailty Screening Initiative

- Reviewed all 310 palliative care consults on surgical patients from 2006-2013, comparing patients before (n=160) and after (n=150) implementing the Frailty Screening Initiative (FSI)
  - Decreased in mortality at all time points
    - AOR 180-day mortality: 0.37 (95% CI, 0.22-0.62), controlling for age, frailty and whether the patient had surgery
  - Increased rate of palliative care consultation from 32 to 56/year.
  - More consults ordered by surgeons than internists (56.7% after FSI vs. 24.4% before FSI, p<.05)
  - More consults ordered before surgery (52.0% after FSI vs. 26.3% before FSI, p<.05)
Fig 1. Risk Analysis Index (RAI) form. ADL, Activities of daily living.


Preoperative frailty Risk Analysis Index to stratify patients undergoing carotid endarterectomy


http://dx.doi.org/10.1016/j.jvs.2014.10.009
RAI Frailty Consortium

- Implementing RAI frailty screening in VAs across the country- Omaha, Atlanta, Pittsburgh, Nashville, Phoenix
- UPMC and UNMC implementation
<table>
<thead>
<tr>
<th>Question</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any intentional weight loss of 10 pounds or more in the past 3 months?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any history of renal failure, renal insufficiency, or seeing a nephrologist?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any history of chronic congestive heart failure?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the patient's appetite currently poor?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the patient currently have shortness of breath at rest?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any history of memory loss, functional deficits or cognitive skills in the past 3 months?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the patient reside in a setting other than independent living?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the procedure being done to diagnose cancer?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any disseminated, unresectable mets?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Activities of Daily Living

Independent: No help or oversight - or - help or oversight provided only 1-2 times in the past 7 days.
Supervised: Oversight, supervision or cuing provided 3 or more times during the past 7 days.
Limited assistance: Patient highly involved in activity but received physical help in guided maneuvering of limbs or other non-weight bearing assistance 3 or more times in the last 7 days.
Extensive assistance: Patient performed part of activity in the past 7 days but received help for the following: Weight bearing support - or - full staff performance during the past 7 days.
Total dependence: Full staff performance during the past 7 days.

<table>
<thead>
<tr>
<th>Require any assistance with mobility?</th>
<th>Independent</th>
<th>Supervised</th>
<th>Limited assistance</th>
<th>Extensive Assistance</th>
<th>Total Dependence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Require any assistance to eat?</th>
<th>Independent</th>
<th>Supervised</th>
<th>Limited assistance</th>
<th>Extensive Assistance</th>
<th>Total Dependence</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

<table>
<thead>
<tr>
<th>Require any assistance with the toilet?</th>
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<th>Supervised</th>
<th>Limited assistance</th>
<th>Extensive Assistance</th>
<th>Total Dependence</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

<table>
<thead>
<tr>
<th>Require any assistance with personal hygiene?</th>
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</tr>
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### Scoring

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<tr>
<td>Age Score</td>
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</tr>
<tr>
<td>RAI Total</td>
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### Form Status

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**Save Record**

<table>
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Conclusion

• Frailty is a predictor of poor surgical outcomes in vascular surgery patients

• Implementation of frailty screening is feasible in a busy vascular surgery clinic
• Working on VQI frailty index

<table>
<thead>
<tr>
<th>Frailty category (n = 10)</th>
<th>VQI variable (n = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>Hypertension</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>Congestive heart failure</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>History of coronary artery disease (angina, MI)</td>
</tr>
<tr>
<td></td>
<td>Prior CABG/PCI</td>
</tr>
<tr>
<td></td>
<td>Positive cardiac stress test</td>
</tr>
<tr>
<td></td>
<td>Any ankle-brachial index &lt;0.7</td>
</tr>
<tr>
<td></td>
<td>Prior arterial vascular operation^a</td>
</tr>
<tr>
<td>Peripheral vascular disease</td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>Renal impairment</td>
<td>Creatinine &gt;1.78 mg/dL</td>
</tr>
<tr>
<td></td>
<td>Dialysis</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td></td>
</tr>
<tr>
<td>Lung or respiratory problem</td>
<td>Chronic obstructive pulmonary disease</td>
</tr>
<tr>
<td>Functional dependence</td>
<td>Preadmission living (home/nursing home)</td>
</tr>
<tr>
<td></td>
<td>Preadmission ambulation^b</td>
</tr>
<tr>
<td>Other medical problem</td>
<td>Anemia^c (hemoglobin &lt;13 g/dL, male; &lt;12 g/dL, female)</td>
</tr>
<tr>
<td>Underweight</td>
<td>Body mass index &lt;19 kg/m^2</td>
</tr>
</tbody>
</table>

CABG, Coronary artery bypass grafting; MI, myocardial infarction; PCI, percutaneous coronary intervention.

^aBypass, carotid endarterectomy, aneurysm repair, peripheral vascular intervention, major amputation.

^bAmbulatory, ambulatory with assist, wheelchair, bedridden
Thank you

- Jason Johanning
- Daniel Hall
- Viraj Master
- Kenneth Ogan
- Theodore Johnson
- Philip Goodney
- Douglas Morris
- Paul Garcia
- Peter Wilson
- Paula Tucker

- William Jordan
- John Sweeney
- Craig Coopersmith
- Thomas Dodson
- Atef Salam
- Ravi Veeraswamy
- Luke Brewster
- Yazan Duwayri
- Ravi Rajani
- Reshma Brahmbhatt

5/16/2016
Shipra Arya MD, SM
Assistant Professor of Surgery
Division of Vascular Surgery
Emory University School of Medicine
Atlanta VA Medical Center
Shipra.arya@emory.edu
• http://redcap.upmc.com/surveys/index.php?s=WXDMTW4RHN&__prevpage=1
Implications of Unintended Moderate Hypothermia in Open Vascular Surgery

Ashwander WS, Quinn ME, Knechtle WS, Duwayri YM
No financial disclosures
"Active warming intraoperatively"...attaining a core body "temperature ≥ 36°C within 30 minutes prior or 15 minutes post anesthesia time."
WHO Guidelines for Safe Surgery 2009

Highly recommended:

- Prophylactic antibiotics should be used routinely in all clean-contaminated surgical cases and considered for use in any clean surgical case. When antibiotics are given prophylactically to prevent infection, they should be administered within 1 hour of incision at a dose and with an antimicrobial spectrum that is effective against the pathogens likely to contaminate the procedure. Before skin incision, the team should confirm that prophylactic antibiotics were given within the past 60 minutes. (When vancomycin is used, infusion should be completed within 1 hour of skin incision.)

- Every facility should have a routine sterilization process that includes means for verifying the sterility of all surgical instruments, devices and materials. Indicators should be used to determine sterility and checked before equipment is introduced onto the sterile field. Before induction of anaesthesia, the nurse or other person responsible for preparing the surgical trays should confirm the sterility of the instruments by evaluating the sterility indicators and should communicate any problems to the surgeon and anaesthetist.

- Redosing with prophylactic antibiotics should be considered if the surgical procedure lasts more than 4 hours or if there is evidence of excessive intraoperative bleeding. (When vancomycin is used as the prophylactic agent, there is no need for redosing in operations lasting less than 10 hours.) Antibiotics used for prophylaxis should be discontinued within 24 hours of the procedure.

- Hair should not be removed unless it will interfere with the operation. If hair is removed, it should be clipped less than 2 hours before the operation. Shaving is not recommended as it increases the risk for surgical site infection.

- Surgical patients should receive oxygen throughout the perioperative period according to individual requirements.

- **Measures to maintain core normothermia should be taken throughout the perioperative period.**

- The skin of all surgical patients should be prepared with an appropriate antiseptic agent before surgery. The antimicrobial agent should be selected on the basis of its ability to decrease the microbial count of the skin rapidly and its persistent efficacy throughout the operation.
Original Contributions

Perioperative Maintenance of Normothermia Reduces Morbid Cardiac Events: A Randomized Clinical Trial

Steven M. Frank, MD; Lee A. Fletcher, MD; Michael J. Bravata, MD; Mitchel K. Flegal, MD; Susan K. Kelly, RN; Charles Beattie, MD

Objective—To assess the relationship between body temperature and morbidity during the perioperative period.

Design—Randomized controlled trial comparing routine thermal care (thermic gel) group to additional supplemental warming (normothermic gel) group.

Setting—Operating rooms and surgical intensive care unit at an academic medical center.

Subjects—Three hundred patients undergoing abdominal, thoracic, or vascular surgery who were randomly assigned to either a normothermic (standard) group or one of two warmed groups (local and systemic). The applied warming for at least 30 min before surgery.

Results—In patients undergoing cardiac surgery, the relative risk of a morbid cardiac event (including ischemia, cardiac arrest, or myocardial infarction) was 0.68 (95% CI, 0.45 to 1.00) in the normothermic gel group compared with the routine thermic gel group. In patients undergoing vascular surgery, the relative risk of a morbid cardiac event was 0.58 (95% CI, 0.34 to 0.97) in the normothermic gel group compared with the routine thermic gel group.

Conclusion—Routine maintenance of normothermia is associated with reduced incidence of morbid cardiac events and vascular tachycardia.

From the Department of Thoracic and Cardiovascular Surgery, University of California, San Francisco, San Francisco, CA; the University of Alabama at Birmingham, Birmingham, AL; and the Department of Surgery, St. Louis University, St. Louis, MO.

Supported by grants from NIH/NHLBI and from the National Institutes of Health, Department of Health and Human Services, Bethesda, MD.

Address reprint requests to Dr. John S. Halstenson, MD, Section of Cardiothoracic Surgery, University of California, San Francisco, CA 94143-0129 (e-mail: john.halstenson@ucsf.edu).


Effects of preoperative warming on the incidence of wound infection after clean surgery: a randomised controlled trial

Andrew C Melting, Başar Ak, Elwin M Scott, David J Laver

Introduction—Wound infection remains one of the most common causes of morbidity in the surgical patient due to the widespread use of prophylactic antibiotics. The wound infection rate is variable and difficult to control, and hospital care costs escalate whenever wound infection occurs. Postoperative wound infection is associated with increased hospital stay, increased cost, and improved morbidity.

Methods—621 patients having clean (first or second) surgery, including classic knee arthroplasty, were randomly assigned to either a preoperative warming group or a control group. A water-filled mattress was used to prewarm patients for 30 min. The infection rate was measured for up to 30 days.

Results—In the preoperative warming group, the infection rate was 5.9% (95% CI, 3.7% to 9.0%), whereas the control group had an infection rate of 10.8% (95% CI, 7.2% to 15.5%). The difference in the infection rate was statistically significant (p = 0.05).

Conclusion—Preoperative warming is associated with a reduction in the incidence of wound infection after clean surgery.
### Table: 33 ACO Quality Measures

<table>
<thead>
<tr>
<th>Domain</th>
<th>Measure</th>
<th>Description</th>
<th>PY1</th>
<th>PY2</th>
<th>PY3</th>
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<tbody>
<tr>
<td>Patient/caregiver experience</td>
<td>ACO #1</td>
<td>Gaining timely care, appointments, and information</td>
<td>R</td>
<td>P</td>
<td>P</td>
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<tr>
<td>Patient/caregiver experience</td>
<td>ACO #2</td>
<td>Meet with your doctors communicate</td>
<td>R</td>
<td>P</td>
<td>P</td>
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<tr>
<td>Patient/caregiver experience</td>
<td>ACO #3</td>
<td>Patients’ rating of doctor</td>
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<td>P</td>
<td>P</td>
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<tr>
<td>Patient/caregiver experience</td>
<td>ACO #4</td>
<td>Access to specialists</td>
<td>R</td>
<td>P</td>
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<tr>
<td>Patient/caregiver experience</td>
<td>ACO #5</td>
<td>Health information and education</td>
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<tr>
<td>Patient/caregiver experience</td>
<td>ACO #6</td>
<td>Shared Decision Making</td>
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<tr>
<td>Patient/caregiver experience</td>
<td>ACO #7</td>
<td>Health status/Functional status</td>
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<tr>
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<td>Risk Standardized, All Condition Readmissions</td>
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<tr>
<td>Care Coordination/Patient Safety</td>
<td>ACO #9</td>
<td>ASC Admissions: COPD or Asthma in Older Adults</td>
<td>R</td>
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<td>Care Coordination/Patient Safety</td>
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<td>Percent of POCs who Qualified for EHR Incentive Payment</td>
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<td>P</td>
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<tr>
<td>Care Coordination/Patient Safety</td>
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<td>Medication Reconciliation</td>
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<tr>
<td>Care Coordination/Patient Safety</td>
<td>ACO #13</td>
<td>Falls: Screening for Fall Risk</td>
<td>R</td>
<td>P</td>
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<tr>
<td>Preventive Health</td>
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<td>Influenza Immunization</td>
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<tr>
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<td>Adult Weight Screening and Follow-up</td>
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<td>Preventive Health</td>
<td>ACO #17</td>
<td>Tobacco Use Assessment and Cessation Intervention</td>
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<td>P</td>
<td>P</td>
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<tr>
<td>Preventive Health</td>
<td>ACO #18</td>
<td>Depression Screening</td>
<td>R</td>
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<tr>
<td>Preventive Health</td>
<td>ACO #19</td>
<td>Colonoscopy and/or Screening for Colon Cancer Screening</td>
<td>R</td>
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<td>R</td>
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<tr>
<td>Preventive Health</td>
<td>ACO #20</td>
<td>Mammography Screening</td>
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<td>Preventive Health</td>
<td>ACO #21</td>
<td>Proportion of Adults who had blood pressure screened in past 2 years</td>
<td>R</td>
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<td>P</td>
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<tr>
<td>At Risk Population Diabetes</td>
<td>Diabetes</td>
<td>ACO #22, Hemoglobin ASC control (HbaA1c) (8 percent)</td>
<td>R</td>
<td>P</td>
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<tr>
<td>At Risk Population Diabetes</td>
<td>Composites</td>
<td>ACO #23, Low Density Lipoprotein (LDL) (&lt;100 mg/dL)</td>
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<tr>
<td>At Risk Population Hypertension</td>
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<td>Blood Pressure (BP) &lt;115/75</td>
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<td>At Risk Population NVD</td>
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<td>ACO #27, Adult Weight Screening and Follow-up</td>
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<td>At Risk Population CAD</td>
<td>ACO #28</td>
<td>Proportion of beneficiaries with diabetes whose HbaA1c in poor control</td>
<td>R</td>
<td>P</td>
<td>P</td>
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<tr>
<td>At Risk Population CAD</td>
<td>ACO #29</td>
<td>Percent of beneficiaries with diabetes whose HbaA1c in poor control</td>
<td>R</td>
<td>P</td>
<td>P</td>
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<tr>
<td>At Risk Population CAD</td>
<td>ACO #30</td>
<td>Percent of beneficiaries with diabetes whose HbaA1c in poor control</td>
<td>R</td>
<td>P</td>
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<tr>
<td>At Risk Population CAD</td>
<td>ACO #31</td>
<td>Drug Therapy for Lowering LDL, Cholesterol</td>
<td>R</td>
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<td>At Risk Population CAD</td>
<td>ACO #32</td>
<td>ACO #33, ACE inhibitor or ARB Therapy for Patients with CAD and diabetes</td>
<td>R</td>
<td>P</td>
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</tr>
</tbody>
</table>

Notes: PY = Performance Year
How does perioperative core body temperature affect outcomes in open vascular surgery?
Hypothermia during elective abdominal aortic aneurysm repair: The high price of avoidable morbidity

Harry L. Bush, Jr., MD, Lynn J. Hyde, RS, Eva Fischer, MD, Gary A. Fantus, MD, Michael P. Silano, MD, and Phillip S. Bardin, MD, New York, N.Y.

Purpose: Adverse outcomes apparently associated with hypothermia led us to examine patients undergoing elective abdominal aortic aneurysm (AAA) repairs to test the hypothesis that hypothermia (temperature less than 34.5°C) is associated with increased mortality and excessive mortality rates.

Methods: Two hundred sixty-two elective AAA repairs were retrospectively reviewed for preoperative and intraoperative risk factors. Core temperatures, age, Acute Physiology and Chronic Health Evaluation (APACHE) II and APACHE II scores (raw and temperature-adjusted), fluid resuscitation, and perioperative organ dysfunction were recorded prospectively. Outcome measures included length of stay in the intensive care unit and in the hospital, and hospital mortality rates.

Results: Except for a higher risk of hypothermia in women (p < 0.05), by univariate analysis, preoperative risk factors were similar in patients in the hypothermic and normothermic groups. After operation, patients with hypothermia had significantly greater APACHE scores (p < 0.0001), and patients in the hypothermic group were significantly longer to recover (p < 0.05), suggesting reduced hyperthermia. Patients with hypothermia had significantly greater blood (p < 0.05), transfusion (p < 0.01), vasopressor (p < 0.05), and isotropic (p < 0.05) requirements, resulting in significantly higher incidences of organ dysfunction (53.9% vs 28.7%, p < 0.01) and death (12.1% vs 1.5%, p < 0.05), and markedly prolonged lengths of stay in the unit (9.5 ± 4.6 vs 1.3 ± 0.6, p < 0.05) and in the hospital (34.3 ± 20.2 vs 15.0 ± 8.8, p < 0.01). Multivariate analysis, female gender (p = 0.004) was the only predictor of intravascular hypothermia, whereas initial hypothermia was significantly predictive of both prolonged hypothermia and development of organ failure (p < 0.05). Organ failure (p < 0.05) and acute myocardial infarction (p < 0.05) were independent predictors of death.

Conclusions: After AAA repair, patients with hypothermia have significant physiologic derangements associated with adverse outcomes. Although multiple etiologic factors are interacting, body temperature is the variable that should be controlled during aortic surgery.

During the past 15 years, patients undergoing repair of abdominal aortic aneurysms (AAA) have benefited from a progressive reduction in peroperative mortality and morbidity rates. These advances are due in large part to the understanding, identification, and prevention of perioperative cardiac events. By use of current techniques of perioperative cardiac assessment, monitoring, and therapy, clinical experiences with more than 3000 patients reported over the last 5 years have a mortality rate of 1.9% with elective AAA repair. Acute resection, like other major abdominal operations, is frequently associated with hypothermia. Incidental hypothermia during major abdominal surgery has been difficult to prevent. Therefore the role that moderate hypothermia plays in perioperative mortality and morbidity has been difficult to define. Hypothermia could play a beneficial role by protect.
Methods

- Retrospective analysis of prospectively maintained database: January 1, 2008 – October 20, 2013
  - Open abdominal aortic aneurysm repair
  - Carotid endarterectomy
  - Suprainguinal bypass
  - Infrainguinal bypass
Methods

• Database: patient demographics, perioperative event variables

• Electronic medical record: temperature data, duration of surgery
  – Mean intraoperative temperature
  – Last intraoperative temperature
  – First postoperative temperature

* All patients were actively warmed. Any observed hypothermia was unintentional.
Methods

• Primary endpoints:
  – 30-day mortality
  – Any postoperative complication

• Secondary endpoints:
  – Wound complication
  – Re-operation
  – Length of stay
  – Readmission
  – Myocardial infarction
## AAA Demographics

<table>
<thead>
<tr>
<th></th>
<th>Normothermic, MEAN (%); n=19</th>
<th>Hypothermic, MEAN (%); n=13</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male sex</td>
<td>15 (79)</td>
<td>9 (69)</td>
<td>0.53</td>
</tr>
<tr>
<td>BMI&gt;25</td>
<td>13 (68)</td>
<td>8 (62)</td>
<td>0.68</td>
</tr>
<tr>
<td>NIDDM</td>
<td>4 (22)</td>
<td>1 (8)</td>
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</tr>
<tr>
<td>IDDM</td>
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<td>0</td>
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<tr>
<td>Smoker</td>
<td>9 (50)</td>
<td>4 (31)</td>
<td>0.28</td>
</tr>
<tr>
<td>CKD</td>
<td>1 (5)</td>
<td>4 (31)</td>
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</tr>
<tr>
<td>ESRD</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Chronic steroids</td>
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<td>0</td>
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# CEA Demographics

<table>
<thead>
<tr>
<th></th>
<th>Normothermic, MEAN (%); n=134</th>
<th>Hypothermic, MEAN (%); n=77</th>
<th>P value</th>
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<tbody>
<tr>
<td>Male sex</td>
<td>75 (56)</td>
<td>50 (65)</td>
<td>0.20</td>
</tr>
<tr>
<td>BMI&gt;25</td>
<td>93 (70)</td>
<td>48 (62)</td>
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<tr>
<td>NIDDM</td>
<td>22 (17)</td>
<td>12 (16)</td>
<td>0.61</td>
</tr>
<tr>
<td>IDDM</td>
<td>22 (17)</td>
<td>9 (12)</td>
<td>0.61</td>
</tr>
<tr>
<td>Smoker</td>
<td>31 (23)</td>
<td>14 (18)</td>
<td>0.39</td>
</tr>
<tr>
<td>CKD</td>
<td>23 (17)</td>
<td>9 (12)</td>
<td>0.29</td>
</tr>
<tr>
<td>ESRD</td>
<td>3 (2)</td>
<td>2 (3)</td>
<td>0.87</td>
</tr>
<tr>
<td>Chronic steroids</td>
<td>3 (2)</td>
<td>3 (4)</td>
<td>0.49</td>
</tr>
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</table>
## IIB Demographics

<table>
<thead>
<tr>
<th></th>
<th>Normothermic, MEAN (%); n=152</th>
<th>Hypothermic, MEAN (%); n=55</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male sex</td>
<td>99 (65)</td>
<td>38 (69)</td>
<td>0.59</td>
</tr>
<tr>
<td>BMI&gt;25</td>
<td>96 (63)</td>
<td>34 (62)</td>
<td>0.86</td>
</tr>
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<td>NIDDM</td>
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<tr>
<td>IDDM</td>
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<td>11 (20)</td>
<td>0.32</td>
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<tr>
<td>Smoker</td>
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<td>23 (43)</td>
<td>0.96</td>
</tr>
<tr>
<td>CKD</td>
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<td>12 (22)</td>
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</tr>
<tr>
<td>ESRD</td>
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<td>1 (2)</td>
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<tr>
<td>Chronic steroids</td>
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</tr>
<tr>
<td></td>
<td>Normothermic, MEAN (%); n=119</td>
<td>Hypothermic, MEAN (%); n=55</td>
<td>P value</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------</td>
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</tr>
<tr>
<td>Male sex</td>
<td>75 (63)</td>
<td>27 (49)</td>
<td>0.08</td>
</tr>
<tr>
<td>BMI&gt;25</td>
<td>63 (53)</td>
<td>26 (48)</td>
<td>0.56</td>
</tr>
<tr>
<td>NIDDM</td>
<td>7 (6)</td>
<td>5 (9)</td>
<td>0.25</td>
</tr>
<tr>
<td>IDDM</td>
<td>16 (14)</td>
<td>3 (6)</td>
<td>0.25</td>
</tr>
<tr>
<td>Smoker</td>
<td>76 (63)</td>
<td>33 (62)</td>
<td>0.73</td>
</tr>
<tr>
<td>CKD</td>
<td>17 (14)</td>
<td>4 (7)</td>
<td>0.18</td>
</tr>
<tr>
<td>ESRD</td>
<td>6 (5)</td>
<td>0</td>
<td>0.09</td>
</tr>
<tr>
<td>Chronic steroids</td>
<td>4 (3)</td>
<td>2 (4)</td>
<td>0.91</td>
</tr>
</tbody>
</table>
% Hypothermic

Combined hypothermia: 32% MEAN, 17% LOR, 8% PACU
% Mortality

- Hypothermic (MEAN)
- Normothermic (MEAN)

### AAA
- Hypothermic: 31% (n=4)
- Normothermic: 16% (n=3)
- P = 0.31

### CEA
- Hypothermic: 0% (n=1)
- Normothermic: 1% (n=3)

### SIB
- Hypothermic: 11% (n=6)
- Normothermic: 3% (n=4)
- P = 0.05

### IIB
- Hypothermic: 0% (n=3)
- Normothermic: 2% (n=3)
- P = 0.29
% Any Complication

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Hypothermic (MEAN)</th>
<th>Normothermic (MEAN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>31% (n=4)</td>
<td>74% (n=14)</td>
</tr>
<tr>
<td>CEA</td>
<td>8% (n=6)</td>
<td>7% (n=9)</td>
</tr>
<tr>
<td>SIB</td>
<td>24% (n=13)</td>
<td>37% (n=43)</td>
</tr>
<tr>
<td>IIB</td>
<td>17% (n=9)</td>
<td>22% (n=31)</td>
</tr>
</tbody>
</table>

P = 0.02
P = 0.81
P = 0.08
P = 0.44
% Wound Complication

- **AAA**: 5% (P = 0.74, n=3)
- **CEA**: 1% (P = 0.91, n=1), 1% (P = 0.91, n=2)
- **SIB**: 4% (P = 0.08, n=14), 12% (P = 0.08, n=14)
- **IIB**: 7% (P = 0.66, n=4), 9% (P = 0.66, n=14)

% Return to OR

- **AAA**: 26% (P = 0.46, n=5)
- **CEA**: 15% (P = 0.64, n=1), 1% (P = 0.64, n=3)
- **SIB**: 13% (P = 0.58, n=19), 1% (P = 0.58, n=19)
- **IIB**: 7% (P = 0.57, n=4), 18% (P = 0.57, n=27)
Mean Length of Stay (d)

<table>
<thead>
<tr>
<th></th>
<th>Hypothermic (MEAN)</th>
<th>Normothermic (MEAN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>8.85</td>
<td>16.42</td>
</tr>
<tr>
<td>CEA</td>
<td>2.45</td>
<td>3.82</td>
</tr>
<tr>
<td>SIB</td>
<td>11.18</td>
<td>11.02</td>
</tr>
<tr>
<td>IIB</td>
<td>7.85</td>
<td>9.42</td>
</tr>
</tbody>
</table>

% 30d Readmission

<table>
<thead>
<tr>
<th></th>
<th>Hypothermic (MEAN)</th>
<th>Normothermic (MEAN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>8%</td>
<td>16%</td>
</tr>
<tr>
<td>CEA</td>
<td>10%</td>
<td>8%</td>
</tr>
<tr>
<td>SIB</td>
<td>18%</td>
<td>5%</td>
</tr>
<tr>
<td>IIB</td>
<td>16%</td>
<td>15%</td>
</tr>
</tbody>
</table>

P = 0.50
P = 0.59
P = 0.03
P = 0.26
% Myocardial Infarction (30d)

Hypothermic (MEAN) vs. Normothermic (MEAN)

- AAA: 4% (n=3) vs. 2% (n=3)
P = NS
- CEA: 2% (n=1) vs. 2% (n=1)
P = NS
- SIB: 2% (n=1) vs. 2% (n=5)
P = NS
- IIB: 3% (n=1) vs. 2% (n=5)
P = NS
Conclusions

• We found no significant association between moderate hypothermia and adverse outcomes.

• Given the universal application of SCIP measures and subsequent emphasis on intraoperative warming, larger scale studies are warranted to further address the effect of perioperative core body temperature on outcomes of open vascular procedures.
Conclusions

• Accepting imposed guidelines without proving efficacy $\rightarrow$ increased resource utilization with no clear benefit to patients.

• VQI $\rightarrow$ proactive in determining which measures make a difference in our patients.
FL-GA Vascular Study Group
Data Abstractor Breakout

William Ashwander, M.D.
Vascular Surgery Fellow
Emory University
VQI Procedures

• Carotid Artery Stent
• Carotid Endarterectomy
• Endovascular AAA Repair
• Open AAA Repair
• Hemodialysis Access
• IVC Filter
• Lower Extremity Bypass – Infra-inguinal
• Lower Extremity Bypass – Supra-inguinal
• Lower Extremity Amputation
• Peripheral Vascular Intervention
• Thoracic and Complex EVAR
• Varicose Vein
Peripheral Vascular Intervention

Inclusion: Percutaneous and/or cut-down interventional procedures of native leg arteries from the infrarenal aorta distally, both primary and secondary interventions (same site), including balloon angioplasty, stenting, and atherectomy for occlusive disease of the infrarenal aorta or distal arteries and true aneurysms of the iliac or distal arteries. Note that attempted interventional procedures that were technically unsuccessful because the lesion could not be crossed should be entered. Note that isolated thrombolysis or mechanical clot extraction are not captured, unless lysis is done as an adjunct to primary treatment of an atherosclerotic lesion.

Exclusions:
- Treatment of vein or prosthetic grafts (this treatment is captured on the follow-up form for the original bypass)
- Abdominal aortic aneurysms (which are captured under EVAR).
- Mesenteric or renal peripheral vascular interventions. (PVI is limited to lower extremity peripheral vascular interventions.)
- Internal Iliac interventions
- Diagnostic procedures not associated with interventions
- Isolated endarterectomy, thrombolysis or mechanical thrombectomy
- Treatment of an infected aneurysm
- Intervention done for trauma
- Pseudoaneurysm

Follow-up Requirement:
- One follow-up 9 – 21 months post procedure
Type A Lesions
- Unilateral or Bilateral Stenoses of CIA
- Unilateral or Bilateral Single Short (≤3 cm) Stenosis of EIA

Type B Lesions
- Short (≤3 cm) Stenosis of Infrarenal Aorta
- Unilateral CIA Occlusion
- Single or Multiple Stenosis Totaling 3-10 cm Involving the EIA Not Extending Into the CFA
- Unilateral EIA Occlusion Not Involving the Origins of Internal Iliac or CFA

Type C Lesions
- Bilateral CIA Occlusions
- Bilateral EIA Stenosis 3-10 cm Long Not Extending Into the CFA
- Unilateral EIA Stenosis Extending Into the CFA
- Unilateral EIA Occlusions That Involves the Origins of Internal Iliac and/or CFA
- Heavily Calcified Unilateral EIA Occlusion With or Without Involvement of Origins of Internal Iliac and/or CFA

Type D Lesions
- Infra-renal Aortoiliac Occlusion
- Diffuse Disease Involving the Aorta and Both Iliac Arteries Requiring Treatment
- Diffuse Multiple Stenoses Involving the Unilateral CIA, EIA, and CFA
- Unilateral Occlusions of both CFA and EIA
- Bilateral Occlusions of EIA
- Iliac Stenoses in Patients with AAA Requiring Treatment and Not Amenable to Endograft Placement or Other Lesions Requiring Open Aortic or Iliac Surgery
Type A lesions
- Single stenosis ≤10 cm in length
- Single occlusion ≤5 cm in length

Type B lesions:
- Multiple lesions (stenoses or occlusions), each ≤5 cm
- Single stenosis or occlusion ≤15 cm not involving the infrageniculate popliteal artery
- Single or multiple lesions in the absence of continuous tibial vessels to improve inflow for a distal bypass
- Heavily calcified occlusion ≤5 cm in length
- Single popliteal stenosis

Type C lesions
- Multiple stenoses or occlusions totaling >15 cm with or without heavy calcification
- Recurrent stenoses or occlusions that need treatment after two endovascular interventions

Type D lesions
- Chronic total occlusions of CFA or SFA (>20 cm, involving the popliteal artery)
- Chronic total occlusion of popliteal artery and proximal trifurcation vessels
VQI Procedures

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Diseases of Thoracic & Thoracoabdominal Aorta

Anatomy: ascending aorta, innominate, right subclavian, right common carotid, left common carotid, left subclavian, descending aorta, celiac, superior mesenteric, renals

Pathology: aneurysm, dissection, aneurysm from dissection, penetrating aortic ulcer, intramural hematoma
Thoracic & Complex EVAR

Inclusion: Primary endovascular repair of thoracic aortic pathology, including aneurysm, dissection, aneurysm from dissection, trauma, Penetrating Ulcer (PAU), Intramural Hematoma (IMH), PAU with IMH or Aortic Thrombus. Also included is thoraco-abdominal (type 1-4/5) and supra-renal and juxtarenal AAA, including visceral/renal/great vessels managed with fenestration, branch graft, or debranching bypass.

Exclusions:
- Repairs done for infected aneurysms or pseudoaneurysm
- Infra-renal AAA (captured in EVAR module)
- Revisions of prior open or endovascular thoracic aortic and thoraco-abdominal repairs in the same zone, with the exception of aneurysmal degeneration of prior visceral or intercostal patch during open thoracic/thoracoabdominal repair, which should be included.
- All repairs done for infectious etiologies (eg, mycotic aneurysms, aortoesophageal fistula, aortobronchial fistula, aortogastric fistula)
- Dissection treated in the descending aorta which represents an extension of previously repaired Type A dissection

Follow-up Requirement:
- One follow-up 9 – 21 months post procedure
Thoracic & Complex EVAR
VQI Procedures

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Cerebrovascular Disease

Anatomy: common carotid, internal carotid, external carotid arteries

Pathology: atherosclerotic plaque causes stenosis/occlusion or embolization causing TIA or stroke

Pre-operative classification: asymptomatic vs. symptomatic

Imaging: duplex, CTA, MRA, arteriography

Treatment: carotid endarterectomy, carotid artery stent
Carotid Artery Stent

Inclusion: Carotid artery stents that involve the carotid bifurcation or are isolated to the internal or common carotid artery that may be performed by percutaneous or open (cut down) approach. Both primary and redo stenting is included. Unlike other procedures, stenting for trauma is also included. Typically, the carotid bifurcation or internal carotid artery is treated, but sometimes an isolated common carotid stenosis is treated alone, or in combination with a bifurcation/internal carotid stent. The data entry form allows either or both locations to be recorded for compliance with CMS Carotid Stent reporting.

Exclusions:
- External Carotid Artery, Intracranial Carotid Artery stents (above C1)

Follow-up Requirement:
- One follow-up 9 – 21 months post procedure
Carotid Artery Stent

Common Carotid Artery
Pre-dilate Before Protection Device □ No □ Yes
Protection Device □ None □ Angioguard □ Accunet □ Filterwire
□ Percusurge □ Retrograde Flow □ Neuroshield □ Other
□ Emboshield □ Spider
Technical Failure □ No □ Yes
If Technical Failure is Yes,
Cause of Failure □ Can't Canulate CCA + Sheath □ Can't cross lesion □ Other
If Technical Failure is No:
Pre-dilate Before Stent □ No □ Yes
Stent Type □ Wall □ Precise □ Acculink □ Other □ Xact □ Nexstent □ Vivexx
Stent Diameter □ mm □ Tapered □ No □ Yes
Number of Stents □ □ Post Dilate □ No □ Yes
Stent Length □ mm
Balloon Diameter □ mm (largest size used during procedure)

Bifurcation or ICA
Pre-dilate Before Protection Device □ No □ Yes
Protection Device □ None □ Angioguard □ Accunet □ Filterwire
□ Percusurge □ Retrograde Flow □ Neuroshield □ Other
□ Emboshield □ Spider
Technical Failure □ No □ Yes
If Technical Failure is Yes,
Cause of Failure □ Can't Canulate CCA + Sheath □ Can't cross lesion □ Other
If Technical Failure is No:
Pre-dilate Before Stent □ No □ Yes
Stent Type □ Wall □ Precise □ Acculink □ Other □ Xact □ Nexstent □ Vivexx
Stent Diameter □ mm □ Tapered □ No □ Yes
Number of Stents □ □ Post Dilate □ No □ Yes
Stent Length □ mm
Balloon Diameter □ mm (largest size used during procedure)
Carotid Endarterectomy

Inclusion: Conventional or eversion endarterectomy of the carotid bifurcation that extends into the internal carotid artery. Both primary and redo operations are included, and specified on the data form. Concomitant procedures such as CABG or proximal carotid stenting are specified on the data form.

Exclusions:
- Isolated common or external carotid endarterectomy that does not involve the internal carotid artery, or bypass grafts for carotid disease. Such procedures are infrequently performed and should not be grouped with carotid Endarterectomy. Infected patches are excluded unless a distinct Endarterectomy is performed at the same surgical session.

Follow-up Requirement:
- One follow-up 9 – 21 months post procedure
# Carotid Endarterectomy

<table>
<thead>
<tr>
<th>Urgency</th>
<th>Elective</th>
<th>Urgent</th>
<th>Emergent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side</td>
<td>Right</td>
<td>Left</td>
<td></td>
</tr>
<tr>
<td>Patch Type</td>
<td>None</td>
<td>Prosthetic</td>
<td></td>
</tr>
<tr>
<td>Shunt</td>
<td>No</td>
<td>Yes (routine)</td>
<td>Yes (pre-op indication)</td>
</tr>
<tr>
<td>Skin Prep</td>
<td>Chlorhexidine</td>
<td>Alcohol</td>
<td>Iodine</td>
</tr>
<tr>
<td>Drain</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Protamine</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Re-explore artery after closure?</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Monitoring:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EEG</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Stump Pressure</td>
<td>No</td>
<td>Yes</td>
<td>Other</td>
</tr>
<tr>
<td>Heart Rate:</td>
<td>On Arrival in OR</td>
<td>completion Doppler</td>
<td>completion Arteriogram</td>
</tr>
<tr>
<td></td>
<td></td>
<td>completion Duplex</td>
<td>completion other arterial op</td>
</tr>
<tr>
<td></td>
<td>bpm</td>
<td>bpm</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
VQI Procedures

- Carotid Artery Stent
- Carotid Endarterectomy
- Endovascular AAA Repair
- Open AAA Repair
- Hemodialysis Access
- IVC Filter
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- Lower Extremity Bypass – Supra-inguinal
- Peripheral Vascular Intervention
- Lower Extremity Amputation
- Thoracic and Complex EVAR
Abdominal Aortic Aneurysm

Anatomy: infrarenal aorta, iliac arteries, renal arteries

Pathology: aortic wall weakens, “balloons out”, ruptures

Pre-operative classification: asymptomatic vs. symptomatic

Imaging: US, CTA, MRA

Treatment: open vs. endovascular repair
Endovascular AAA Repair

Inclusion: Primary endovascular repair of degenerative infrarenal aortic aneurysms that may include iliac aneurysms. Uncovered stent grafts extending above the renal arteries are included. This includes failed endovascular AAA repairs that convert to open AAA repair during the index procedure.

Exclusions:
- Revision of previous endografts (which is captured on the follow-up form for that procedure).
- Supra-renal covered stents with renal fenestrations or branches (which are entered under TEVAR/Complex EVAR).
- Isolated iliac aneurysms, which are captured as peripheral vascular interventions.
- Operations done for infected aneurysms.
- Operations done for anastomotic aneurysm (Pseudoaneurysm)
- EVAR performed for non-aneurysmal infrarenal pathology, such as isolated dissection or atherosclerotic occlusive disease (the latter is captured under PVI, the former is not captured in the VQI registry).
- Repair done for trauma

Follow-up Requirement:
- One follow-up 9 – 21 months post procedure
Endovascular AAA Repair
Open AAA Repair

Inclusion: Primary open and conversion from endovascular repair of infra-renal aortic aneurysms that may include iliac aneurysm repair by abdominal surgery with the proximal anastomosis distal to the renal arteries. Suprarenal clamping is recorded, as is renal bypass for occlusive disease. Note that AAAs that are below the main renal arteries that require ligation of a small accessory renal artery are included.

Exclusions:
- Aortic aneurysms that involve a major renal artery such that the proximal aortic anastomosis is above at least one major renal artery so that re-implantation or bypass of a renal artery is required. Note that infra-renal AAA repair with renal bypass was done for renal artery occlusive disease is included and the renal bypass is captured as a concomitant procedure.
- Revisions of previous abdominal aortic aneurysm open repairs.
- Isolated iliac aneurysm that does not involve anastomosis to the aorta.
- Repairs done for infected aneurysms
- Repair done for trauma
- Operations done for anastomotic aneurysm(Pseudoaneurysm) as this is not a primary repair

Follow-up Requirement:
- One follow-up 9 – 21 months post procedure
# Open AAA Repair

<table>
<thead>
<tr>
<th>Anesthesia</th>
<th>Conversion from Endo AAA</th>
<th>Renal/Visceral Ischemic Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ General</td>
<td>□ No</td>
<td>_____ minutes</td>
</tr>
<tr>
<td>□ General + Epidural</td>
<td>□ Early</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Late</td>
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<table>
<thead>
<tr>
<th>Exposure</th>
<th>Distal Anastomosis</th>
<th>Graft Body Diameter</th>
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</thead>
<tbody>
<tr>
<td>□ Anterior</td>
<td>□ Aorta</td>
<td>_____ mm</td>
</tr>
<tr>
<td>□ Retroperitoneal</td>
<td>□ CIA</td>
<td></td>
</tr>
<tr>
<td>□ Dacron, woven</td>
<td>□ EIA</td>
<td></td>
</tr>
<tr>
<td>□ Dacron, knitted</td>
<td>□ CFA</td>
<td></td>
</tr>
<tr>
<td>□ Dacron, coated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ PTE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Non-autologous biologic</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Graft Type</th>
<th>Hypogastric ligated/occluded</th>
<th>Proximal Clamp Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Occluded</td>
<td>□ None</td>
<td>□ Infrarenal</td>
</tr>
<tr>
<td>□ Ligated</td>
<td>□ Single</td>
<td>□ Above one renals</td>
</tr>
<tr>
<td>□ Reimplanted</td>
<td>□ Both</td>
<td>□ Above both renals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Supraceliac</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IMA at Completion</th>
<th>Currin</th>
<th>Cold Renal Perfusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Occluded</td>
<td>□ No</td>
<td>□ No</td>
</tr>
<tr>
<td>□ Ligated</td>
<td>□ Yes</td>
<td>□ Yes</td>
</tr>
<tr>
<td>□ Reimplanted</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mannitol</th>
<th>Heparin</th>
<th>Crystalloid</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ No</td>
<td>□ No</td>
<td>□ No</td>
</tr>
<tr>
<td>□ Yes</td>
<td>□ Yes</td>
<td>□ Yes</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Autotransfusion</th>
<th>EBL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ ml</td>
<td>□ ml</td>
<td></td>
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<table>
<thead>
<tr>
<th>Total Procedure Time</th>
<th>PRBC (in OR)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ minutes</td>
<td>□ units</td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>On Arrival in OR</td>
<td>□ 100</td>
<td>□ All 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Concomitant Procedure</th>
<th>Thromboembolectomy</th>
<th>Renal Bypass</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ No</td>
<td>□ No</td>
<td>□ Yes</td>
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</table>

<table>
<thead>
<tr>
<th>Infra-Inguinal Bypass</th>
<th>Highest intra-op</th>
<th>Other Abdominal</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ No</td>
<td>□ 100</td>
<td>□ No</td>
</tr>
<tr>
<td>□ Yes</td>
<td></td>
<td>□ Yes</td>
</tr>
</tbody>
</table>
VQI Procedures

- Carotid Artery Stent
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Hemodialysis Access

Anatomy: arteries/veins of arm, thigh

Pathology: ESRD requiring long-term conduit for hemodialysis

Imaging: vein mapping, venography, fistulogram

Treatment: arteriovenous fistula vs. arteriovenous graft
Hemodialysis Access

Inclusion: Arterio-venous fistulas or grafts. This includes A-V fistulas using transposed veins and A-V grafts using autogenous, prosthetic or biological material. Note: The second stage of a Hemodialysis Access procedure (i.e. basilic transposition) should be captured on the early follow-up form for the original procedure entered in VQI.

Exclusions:
- Insertion of temporary cannulas that are not tunneled
- Tunneled Catheters
- Thrombectomy or revision of existing access (which is captured on follow-up form from initial access procedure)
- Percutaneous thrombectomy, angioplasty or stenting of existing access (which is captured on follow-up form from initial access procedure)
- DRIL or other procedure performed for ischemia related to existing access (which is captured on follow-up form from initial access procedure)

Follow-up Requirement:
- One early follow-up 0 – 6 months post procedure
- One late follow-up 9 – 21 months post procedure
Hemodialysis Access

Status □ Out-patient □ In-patient
Anesthesia □ Local □ Regional □ General
Side □ Right □ Left
Access Type □ AVF □ Prosthetic AV Graft, straight □ Prosthetic AV Graft, looped
□ Autogenous Vein AV Graft □ AV Biograft

If Access Type = Prosthetic AV Graft, straight, or Prosthetic AV Graft, looped, or AV Biograft,
Reason Not Autogenous □ Need acute access □ Vein not available
□ Other, documented □ Not specified

If Access Type = Prosthetic AV Graft, straight, or Prosthetic AV Graft, looped,
choose a combination of graft type, diameter, and configuration from the attached Graft Info List.

Graft Type [ ]
Graft Diameter [ ]
Graft Configuration [ ]

Arterial Anastomosis
□ Radial, snuffbox □ Brachial, antecubital □ Radial, wrist
□ Common Femoral □ Cephalic, wrist □ Brachial, upper arm
□ Cephalic, arm □ Cephalic, forearm □ SFA

Venous Anastomosis
□ Brachial □ Basilic, forearm □ Axillary
□ Femoral □ Basilic, antecubital □ Other

Target Artery Diameter [ ] mm
Target Vein Diameter [ ] mm

If Venous Anastomosis = Basilic, upper arm,
Planned 2nd Stage □ No □ Yes
Concomitant Procedures
□ None □ Venous PTA □ Arterial PTA/Stent
□ Arterial Endarterectomy/Patch

Completion Fistulogram □ No □ Yes
VQI Procedures

- Carotid Artery Stent
- Carotid Endarterectomy
- Endovascular AAA Repair
- Open AAA Repair
- Hemodialysis Access
- **IVC Filter**
- Lower Extremity Bypass – Infra-inguinal
- Lower Extremity Bypass – Supra-inguinal
- Peripheral Vascular Intervention
- Lower Extremity Amputation
- **Thoracic and Complex EVAR**
IVC Filter

Anatomy: inferior vena cava, renal veins, iliac veins, femoral veins, internal jugular veins

Pathology: DVT, PE

Treatment: IVC filter placement (infrarenal/suprarenal)
IVC Filter

Inclusion: Insertion of Inferior Vena Cava (IVC) filter, endovascular approach only, temporary or permanent. Placement can be in the iliacs or any portion of the inferior vena cava. The IVC Filter follow-up form should be completed at the time of filter retrieval. If the filter is not retrieved, follow-up should be done greater than 9 months from the procedure date.

Exclusions:
- Superior Vena Cava IVC filter
- Open insertion of IVC filter
- Repositioning or Retrieval of IVC filter (this is captured on the follow-up form)

Follow-up Requirement:
- At time of filter retrieval OR one late follow-up 9 – 21 months post procedure
# IVC Filter

<table>
<thead>
<tr>
<th>Planned Duration</th>
<th>□ Temporary</th>
<th>□ Permanent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>□ Fluoro suite</td>
<td>□ Bedside</td>
</tr>
<tr>
<td>Placement Location</td>
<td>□ Fluoro suite</td>
<td>□ Bedside</td>
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<tr>
<td>Imaging</td>
<td>□ Fluoroscopy</td>
<td>□ Ultrasound</td>
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<td></td>
<td>□ IVUS</td>
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</tr>
<tr>
<td>Insertion Site</td>
<td>□ Right jugular</td>
<td>□ Left jugular</td>
</tr>
<tr>
<td></td>
<td>□ Right femoral</td>
<td>□ Left femoral</td>
</tr>
<tr>
<td></td>
<td>□ Right leg vein</td>
<td>□ Left leg vein</td>
</tr>
<tr>
<td>Landing Site</td>
<td>□ Infra-renal</td>
<td>□ Para-renal</td>
</tr>
<tr>
<td></td>
<td>□ Supra-renal</td>
<td>□ Iliac, right</td>
</tr>
<tr>
<td></td>
<td>□ Iliac, left</td>
<td>□ Iliac, bilateral</td>
</tr>
<tr>
<td>Renal Veins Visualized</td>
<td>□ No</td>
<td>□ Cavoxylogy</td>
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<tr>
<td></td>
<td>□ Select catheterization</td>
<td>□ IVUS</td>
</tr>
<tr>
<td>Device Manufacturer</td>
<td>□</td>
<td></td>
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<tr>
<td>Device Type</td>
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</tr>
<tr>
<td>Complications:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venous Injury</td>
<td>□ None</td>
<td>□ Medical treatment</td>
</tr>
<tr>
<td></td>
<td>□ Transfusion</td>
<td>□ Interventional treatment</td>
</tr>
<tr>
<td></td>
<td>□ Surgical treatment</td>
<td></td>
</tr>
<tr>
<td>Placement</td>
<td>□ None</td>
<td>□ Failed to open properly</td>
</tr>
<tr>
<td></td>
<td>□ Deployed &gt;20 mm from intended site</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Deployed in wrong vein</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Embolized to heart</td>
<td></td>
</tr>
<tr>
<td>Angulation</td>
<td>□ Angulated &lt;= 20 degrees</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Angulated &gt; 20 degrees</td>
<td></td>
</tr>
<tr>
<td>Landing Vein Diameter</td>
<td>□ mm</td>
<td>□ Not Assessed</td>
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<td>Abnormal Venous Anatomy</td>
<td>□ No</td>
<td>□ Yes</td>
</tr>
<tr>
<td>(Refer to list on Manufacturer tab)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If Venous Injury, Location</td>
<td>□ Insertion site</td>
<td></td>
</tr>
<tr>
<td>If Placement complication, Treatment</td>
<td>□ Iliac vein</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Vena cava</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ No treatment undertaken</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Treatment undertaken</td>
<td></td>
</tr>
<tr>
<td>If Treatment undertaken, Describe</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VQI Procedures

- Carotid Artery Stent
- Carotid Endarterectomy
- Endovascular AAA Repair
- Open AAA Repair
- Hemodialysis Access
- IVC Filter
- Lower Extremity Amputation
- Lower Extremity Bypass – Infra-inguinal
- Lower Extremity Bypass – Supra-inguinal
- Peripheral Vascular Intervention
- Thoracic and Complex EVAR
Lower Extremity Arterial Occlusive Disease

Anatomy: aorta, common iliac, external iliac, internal iliac (hypogastric), common femoral, superficial femoral, profunda, popliteal, anterior tibial, posterior tibial, peroneal arteries

Pathology: constellation of disorders- stems from atherosclerotic stenoses or occlusions within the lower extremity arterial tree, causing a reduction in blood flow to the leg

Pre-operative classification: claudication, critical limb ischemia (rest pain, tissue loss/gangrene)

Imaging: US, CTA, MRA, arteriography

Treatment: PVI, bypass
Infra-inguinal Bypass

Inclusion: Autogenous or prosthetic bypass in the leg that originates at or distal to the external iliac artery and terminates distal to the ipsilateral common femoris artery, that is performed for occlusive or true aneurysm disease. (Most infra-inguinal grafts originate at or distal to the common femoral artery, but occasionally the external iliac artery may be used for the proximal anastomosis, such as cases where extensive scar or infection exists at the CFA site) Both primary and redo bypass grafts are included. Redo bypass grafts do not include a portion of a previous infra-inguinal graft (see exclusions).

Exclusions:
- Bypass done for pseudoaneurysm or trauma
- Isolated femoral endarterectomy (femoral endarterectomy combined with PVI is captured on PVI form)
- Thrombectomy or embolectomy
- Bypass originating more proximal than the external iliac artery, (which are recorded as suprainguinal).
- Revisions (open or endovascular) of previous bypass grafts (this treatment is captured on the follow-up form for the original bypass). Revisions are defined as surgery that maintains a portion of the original bypass graft.
- Infected aneurysm
- Redo bypass for infected graft

Follow-up Requirement:
- One follow-up 9 – 21 months post procedure
# Infra-inguinal Bypass

<table>
<thead>
<tr>
<th>Urgency</th>
<th>Elective</th>
<th>Emergent</th>
<th>Urgent</th>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side</td>
<td>Right</td>
<td></td>
<td>Left</td>
<td></td>
</tr>
<tr>
<td>Anesthesia</td>
<td>Spinal</td>
<td>Epidural</td>
<td>General</td>
<td></td>
</tr>
<tr>
<td>Skin Prep</td>
<td>Chlorhexidine</td>
<td>Iodine</td>
<td>Chlor + Alcohol</td>
<td>Iodine + Alcohol</td>
</tr>
<tr>
<td>Graft Origin</td>
<td>Ext Iliac</td>
<td>Com Fem</td>
<td>Profunda</td>
<td>SFA</td>
</tr>
<tr>
<td></td>
<td>Profunda</td>
<td></td>
<td>SFA</td>
<td>Profunda</td>
</tr>
<tr>
<td></td>
<td>AK Pop</td>
<td></td>
<td>AK Pop</td>
<td>BK Pop</td>
</tr>
<tr>
<td></td>
<td>Tibial</td>
<td></td>
<td>BK Pop</td>
<td>Peroneal</td>
</tr>
<tr>
<td>Graft Vein Type</td>
<td>None</td>
<td>Reversed GSV</td>
<td>In Situ GSV</td>
<td>Non-reversed Transposed GSV</td>
</tr>
<tr>
<td></td>
<td>Lesser Saph</td>
<td></td>
<td>Cephalic</td>
<td></td>
</tr>
<tr>
<td>Prosthetic</td>
<td>None</td>
<td>Dacron</td>
<td>PTFE</td>
<td>Non-autologous biologic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Composite w/ vein</td>
</tr>
<tr>
<td>Groin Incision</td>
<td>None</td>
<td></td>
<td>Vertical</td>
<td>Total Procedure Time</td>
</tr>
<tr>
<td>If Graft Vein, Vein Harvest Incision</td>
<td>Continuous</td>
<td></td>
<td>Endoscopic</td>
<td>Sub-cutaneous</td>
</tr>
<tr>
<td>Adjuncts: Vein Cuff</td>
<td>No</td>
<td>Yes</td>
<td>Sequential Graft</td>
<td>No</td>
</tr>
<tr>
<td>Heart Rate: On Arrival in OR</td>
<td></td>
<td></td>
<td>Highest intra-op</td>
<td></td>
</tr>
<tr>
<td>Concomitant Proximal Ipsilateral: PVI</td>
<td>No</td>
<td>Yes</td>
<td>Endarterectomy</td>
<td>No</td>
</tr>
<tr>
<td>Supra-inguinal Bypass</td>
<td>No</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completion Study: Doppler</td>
<td>No</td>
<td>Yes</td>
<td>Duplex</td>
<td>No</td>
</tr>
<tr>
<td>Arteriogram</td>
<td>No</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Supra-inguinal Bypass

Inclusion: Autogenous or prosthetic bypass that originates proximal to the external iliac artery or any cross-over bypass grafts that are performed for arterial occlusive disease. Both primary and redo bypass grafts are included. This category includes axillo, thoaco, aorto and ilio femoral bypass, cross-over femoral or iliac bypass, and also grafts originating proximal to the external iliac that terminate in the leg.

Exclusions:
- Bypass done for trauma, dissection, or pseudoaneurysm
- Thrombectomy or embolectomy
- Isolated endarterectomy
- Bypass done to treat aortic or iliac aneurysms (aortic aneurysm are captured on the Open AAA form while isolated open iliac aneurysm repair is not captured, since these are so infrequent)
- Bypass originating at or distal to the external iliac artery which terminates in the ipsilateral leg (which are recorded as infra-inguinal).
- Revisions (open or endovascular) of previous bypass grafts (this treatment is captured as follow-up data from the original bypass). Revisions are defined as surgery that maintains a portion of the original bypass graft.
- Infected aneurysm
- Redo bypass for infected graft

Follow-up Requirement:
- One follow-up 9 – 21 months post procedure
## Supra-inguinal Bypass

<table>
<thead>
<tr>
<th>Urgency</th>
<th>Anesthesia</th>
<th>Skin Prep</th>
<th>Chlorhexidine</th>
<th>Alcohol</th>
<th>EBL</th>
<th>Groin Incision</th>
<th>Total Procedure Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective</td>
<td>Spinal</td>
<td>General</td>
<td>Iodine</td>
<td>Chlor + Iodine</td>
<td>ml</td>
<td>None</td>
<td>minutes</td>
</tr>
<tr>
<td>Urgent</td>
<td>Epidural</td>
<td>Iodine + Alcohol</td>
<td>Chlor + Alcohol</td>
<td>Iodine + Alcohol</td>
<td></td>
<td>Vertical</td>
<td></td>
</tr>
<tr>
<td>Emergent</td>
<td>General</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Horizontal</td>
<td></td>
</tr>
</tbody>
</table>

**Graft Origin:**
- Artery:
  - Axillary
  - Thoracic Aorta
  - Abdominal Aorta, end-side
  - Abdominal Aorta, end-end
  - Com iliac
  - Com Fem
  - Profunda
  - SFA

**Graft Diameter:** mm

**Graft Recipient 1:**
- Artery:
  - Com iliac
  - Ext iliac
  - SFA
  - AK Pop
  - BK Pop
  - Tibial/pedal

**Graft Diameter:** mm

**Concomitant Endarterectomy:**
- No
- Yes

**Heart Rate:**
- On Arrival in OR: bpm
- Highest intra-op: bpm

**Concomitant Infra-Iguinal:**
- Right Bypass: No
- Right PVI: No

**Completion Study:**
- Doppler: No
- Duplex: No
- Arteriogram: No
Peripheral Vascular Intervention

Inclusion: Percutaneous and/or cut-down interventional procedures of native leg arteries from the infrarenal aorta distally, both primary and secondary interventions (same site), including balloon angioplasty, stenting, and atherectomy for occlusive disease of the infrarenal aorta or distal arteries and true aneurysms of the iliac or distal arteries. Note that attempted interventional procedures that were technically unsuccessful because the lesion could not be crossed should be entered. Note that isolated thrombolysis or mechanical clot extraction are not captured, unless lysis is done as an adjunct to primary treatment of an atherosclerotic lesion.

Exclusions:
- Treatment of vein or prosthetic grafts (this treatment is captured on the follow-up form for the original bypass)
- Abdominal aortic aneurysms (which are captured under EVAR).
- Mesenteric or renal peripheral vascular interventions. (PVI is limited to lower extremity peripheral vascular interventions.)
- Internal Iliac interventions
- Diagnostic procedures not associated with interventions
- Isolated endarterectomy, thrombolysis or mechanical thrombectomy
- Treatment of an infected aneurysm
- Intervention done for trauma
- Pseudoaneurysm

Follow-up Requirement:
- One follow-up 9 – 21 months post procedure
Peripheral Vascular Intervention
Lower Extremity Amputation
Lower Extremity Amputation

Inclusion: All lower extremity amputations beginning at the pelvis (hindquarter), through the hip, femur, knee, tibia, fibula, ankle and ending with a transmetatarsal (TMA) through the foot. Also, includes disarticulation amputations when applicable. Amputation indications can be due to ischemic rest pain, ischemic tissue loss (ulcers/gangrene), acute ischemia, uncontrolled infection, or neuropathic tissue loss. Revisions at the same level of the amputation performed at a subsequent visit are only captured on the follow-up form. Any revision at a higher level performed at a subsequent visit would be recorded both on the follow-up form for the original amputation and as a new Lower Extremity Amputation procedure.

Exclusions:
- Toe amputations
- Trauma
- Frostbite
- Debilitating paralysis
- Tumors of the Musculoskeletal system
- Acute compartment syndrome

Follow-up Requirement:
- One follow-up 9 – 21 months post procedure
## Lower Extremity Amputation

<table>
<thead>
<tr>
<th>Urgency</th>
<th>Elective</th>
<th>Urgent</th>
<th>Emergent</th>
<th>Anesthesia</th>
<th>Spinal</th>
<th>Epidural</th>
<th>General</th>
<th>Regional Block</th>
</tr>
</thead>
</table>

### Procedure Information:

**Current Amputation Side**

- Right
- Left
- Bilateral

<table>
<thead>
<tr>
<th>Procedure Details</th>
<th>Right</th>
<th>Left</th>
</tr>
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<tbody>
<tr>
<td><strong>Level</strong></td>
<td></td>
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<tr>
<td>TMA</td>
<td></td>
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<tr>
<td>Hindfoot</td>
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</tr>
<tr>
<td>Ankle</td>
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<tr>
<td>BKA</td>
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<tr>
<td>TKA</td>
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<tr>
<td>AKA</td>
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<td>Higher</td>
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<thead>
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<tr>
<td><strong>Indication</strong></td>
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<tr>
<td>Ischemic Rest Pain</td>
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<td>Ischemic Tissue Loss</td>
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<td>Acute Ischemia</td>
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<tr>
<td>Uncontrolled Infection</td>
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<td>Neuropathic Tissue Loss</td>
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<td>Other</td>
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<td><strong>Dressing</strong></td>
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<td>Gauze only</td>
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<td>Elastic compression dressing</td>
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<tr>
<td>Rigid removable dressing</td>
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<tr>
<td>Fixed plaster cast</td>
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<tr>
<td>Immediate post-op prosthesis (IPOP)</td>
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<table>
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</tr>
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<tbody>
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<td><strong>Planned Staged Amputation</strong></td>
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<tr>
<td>EBL ml</td>
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<tr>
<td>Yes</td>
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<tr>
<td>Total Procedure Time</td>
<td>minutes</td>
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<table>
<thead>
<tr>
<th>Procedure Details</th>
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<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>On Arrival in OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest intra-op</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bpm</td>
<td></td>
<td></td>
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</tbody>
</table>
VQI Procedures

• Carotid Artery Stent
• Carotid Endarterectomy
• Endovascular AAA Repair
• Open AAA Repair
• Hemodialysis Access
• IVC Filter
• Lower Extremity Amputation
• Lower Extremity Bypass – Infra-inguinal
• Lower Extremity Bypass – Supra-inguinal
• Peripheral Vascular Intervention
• Thoracic and Complex EVAR
Type A Lesions
• Unilateral or Bilateral Stenoses of CIA
• Unilateral or Bilateral Single Short (≤3 cm) Stenosis of EIA

Type B Lesions
• Short (≤3 cm) Stenosis of Infrarenal Aorta
• Unilateral CIA Occlusion
• Single or Multiple Stenosis Totaling 3-10 cm Involving the EIA Not Extending Into the CFA
• Unilateral EIA Occlusion Not Involving the Origins of Internal Iliac or CFA

Type C Lesions
• Bilateral CIA Occlusions
• Bilateral EIA Stenosis 3-10 cm Long Not Extending Into the CFA
• Unilateral EIA Stenosis Extending Into the CFA
• Unilateral EIA Occlusions That Involves the Origins of Internal Iliac and/or CFA
• Heavily Calcified Unilateral EIA Occlusion With or Without Involvement of Origins of Internal Iliac and/or CFA

Type D Lesions
• Infra-renal Aortoiliac Occlusion
• Diffuse Disease Involving the Aorta and Both Iliac Arteries Requiring Treatment
• Diffuse Multiple Stenoses Involving the Unilateral CIA, EIA, and CFA
• Unilateral Occlusions of both CFA and EIA
• Bilateral Occlusions of EIA
• Iliac Stenoses in Patients with AAA Requiring Treatment and Not Amenable to Endograft Placement or Other Lesions Requiring Open Aortic or Iliac Surgery
Type A lesions
• Single stenosis ≤10 cm in length
• Single occlusion ≤5 cm in length

Type B lesions:
• Multiple lesions (stenoses or occlusions), each ≤5 cm
• Single stenosis or occlusion ≤15 cm not involving the infrageniculate popliteal artery
• Single or multiple lesions in the absence of continuous tibial vessels to improve inflow for a distal bypass
• Heavily calcified occlusion ≤5 cm in length
• Single popliteal stenosis

Type C lesions
• Multiple stenoses or occlusions totaling >15 cm with or without heavy calcification
• Recurrent stenoses or occlusions that need treatment after two endovascular interventions

Type D lesions
• Chronic total occlusions of CFA or SFA (>20 cm, involving the popliteal artery)
• Chronic total occlusion of popliteal artery and proximal trifurcation vessels
Perioperative Glycemic Control in Vascular Surgery Patients: Poor Control is Associated with Poor Outcomes


Emory University School of Medicine
Department of Surgery
Division of Vascular Surgery and Endovascular Therapy
Background/Objective

- Hyperglycemia is a common occurrence in patients undergoing cardiovascular surgery.
- Improved perioperative glycemic control has been shown to reduced post-operative morbidity and in-hospital mortality in several surgical cohorts.
- A significant portion of the population with PAD suffers from the sequelae of diabetes and/or metabolic syndrome.
  - little data exists regarding perioperative glycemic control and vascular surgery patient outcomes.
- **Objective:** to better understand this relationship between poor post-operative glycemic control and negative perioperative outcomes in vascular surgery patients
Methods

• Retrospective review using a prospectively maintained vascular patient database at a large academic center from 2009-2013.
• Patients underwent carotid endarterectomy and stenting, aortic aneurysm repair, and all supra- and infrainguinal lower extremity revascularization procedures.
• Data were collected on patients demographics, post-operative outcomes, and glucose levels in the perioperative period.
• Perioperative hyperglycemia was defined as at least one glucose reading >180 mg/dl within 72 hrs of index procedure.
• Primary outcome was 30-day mortality
  – Secondary outcomes: MACE, renal failure/insufficiency, transfusion, wound complication (hematoma/dehiscence/SSI), graft thrombosis, return to the OR, and hospital readmission.
Table 1. Baseline demographics stratified by hyperglycemic events of glucose $>$ 180mg/dl

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Total (n=1051)</th>
<th>Glucose $&lt;$ 180 mg/dl (n=685)</th>
<th>Glucose $&gt;$ 180 mg/dl (n=366)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean±sd)</td>
<td>1051</td>
<td>68.25 ± 11.48</td>
<td>67.07 ± 10.72</td>
<td>0.1031*</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (N, %)</td>
<td>670</td>
<td>457 (66.7%)</td>
<td>213 (58.2%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Female (N, %)</td>
<td>381</td>
<td>228 (33.3%)</td>
<td>153 (41.8%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African-American (N, %)</td>
<td>197</td>
<td>118 (17.2%)</td>
<td>79 (21.6%)</td>
<td>0.0846</td>
</tr>
<tr>
<td>Other (N, %)</td>
<td>854</td>
<td>567 (82.8%)</td>
<td>287 (78.4%)</td>
<td>0.0846</td>
</tr>
<tr>
<td><strong>Priority</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergent (N, %)</td>
<td>68</td>
<td>32 (4.7%)</td>
<td>36 (9.8%)</td>
<td>0.0012</td>
</tr>
<tr>
<td>Non-emergent (N, %)</td>
<td>983</td>
<td>653 (95.3%)</td>
<td>330 (90.2%)</td>
<td>0.0012</td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (N, %)</td>
<td>261</td>
<td>83 (12.1%)</td>
<td>178 (48.6%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>No (N, %)</td>
<td>790</td>
<td>602 (87.9%)</td>
<td>188 (51.4%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>Smoking status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (N, %)</td>
<td>408</td>
<td>281 (41.0%)</td>
<td>127 (34.7%)</td>
<td>0.0451</td>
</tr>
<tr>
<td>Non-smoker (N, %)</td>
<td>643</td>
<td>404 (59.0%)</td>
<td>239 (65.3%)</td>
<td>0.0451</td>
</tr>
<tr>
<td><strong>COPD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (N, %)</td>
<td>176</td>
<td>124 (18.1%)</td>
<td>52 (14.2%)</td>
<td>0.1072</td>
</tr>
<tr>
<td>No (N, %)</td>
<td>875</td>
<td>561 (81.9%)</td>
<td>314 (85.8%)</td>
<td>0.1072</td>
</tr>
<tr>
<td><strong>CHF</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (N, %)</td>
<td>47</td>
<td>28 (4.1%)</td>
<td>19 (5.2%)</td>
<td>0.4095</td>
</tr>
<tr>
<td>No (N, %)</td>
<td>1004</td>
<td>657 (65.4%)</td>
<td>347 (94.8%)</td>
<td>0.4095</td>
</tr>
<tr>
<td><strong>BMI</strong> (mean±sd)</td>
<td>1051</td>
<td>26.51 ± 5.4</td>
<td>28.39 ± 6.02</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>Creatinine</strong> (mean±sd)</td>
<td>1051</td>
<td>1.16 ± 0.81</td>
<td>1.33 ± 1.21</td>
<td>0.0171*</td>
</tr>
<tr>
<td><strong>Hypoglycemia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (N, %)</td>
<td>207</td>
<td>91 (13.3%)</td>
<td>116 (31.7%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>No (N, %)</td>
<td>844</td>
<td>594 (86.7%)</td>
<td>250 (68.3%)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

*P-values generated using chi-square test of homogeneity

b Chronic obstructive pulmonary disorder
c Congestive heart failure
d Body mass index
e Student’s t-test
Table 2. Univariate analysis of postoperative outcomes stratified by hyperglycemic events of glucose > 180 mg/dl

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Total</th>
<th>Glucose &lt; 180 mg/dl (n=685)</th>
<th>Glucose &gt; 180 mg/dl (n=366)</th>
<th>P-value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-day mortality (N, %)</td>
<td>N=26</td>
<td>5 (0.7%)</td>
<td>21 (5.7%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Myocardial infarction (N, %)</td>
<td>N=25</td>
<td>9 (1.3%)</td>
<td>16 (4.4%)</td>
<td>0.0019</td>
</tr>
<tr>
<td>Ventilator-dependent &gt; 48 hours (N, %)</td>
<td>N=55</td>
<td>14 (2.0%)</td>
<td>31 (8.5%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Acute renal failure (N, %)</td>
<td>N=24</td>
<td>6 (0.9%)</td>
<td>18 (4.9%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Progressive renal insufficiency (N, %)</td>
<td>N=18</td>
<td>4 (0.6%)</td>
<td>14 (3.8%)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Stroke (N, %)</td>
<td>N=16</td>
<td>5 (0.7%)</td>
<td>11 (3.0%)</td>
<td>0.0041</td>
</tr>
<tr>
<td>Transfusion (N, %)</td>
<td>N=291</td>
<td>143 (20.9%)</td>
<td>148 (40.4%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Wound complications&lt;sup&gt;d&lt;/sup&gt; (N, %)</td>
<td>N=59</td>
<td>27 (3.9%)</td>
<td>32 (8.7%)</td>
<td>0.0013</td>
</tr>
<tr>
<td>Other infection&lt;sup&gt;e&lt;/sup&gt; (N, %)</td>
<td>N=44</td>
<td>13 (1.9%)</td>
<td>31 (8.5%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Graft thrombosis (N, %)</td>
<td>N=2</td>
<td>1 (0.2%)</td>
<td>1 (0.3%)</td>
<td>0.8789&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Return to OR (N, %)</td>
<td>N=35</td>
<td>12 (1.8%)</td>
<td>23 (6.3%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Readmission (N, %)</td>
<td>N=99</td>
<td>54 (7.9%)</td>
<td>45 (12.3%)</td>
<td>0.0197</td>
</tr>
</tbody>
</table>

<sup>a</sup> P-values generated using Fisher’s exact test
<sup>b</sup> Surgical site infection
<sup>c</sup> Composite of wound dehiscence, hematoma, and SSI
<sup>d</sup> Infection other than pneumonia or wound infection
Table 3. Outcomes predicted by hyperglycemia >180 mg/dl on stepwise multivariate logistic regression

<table>
<thead>
<tr>
<th>Outcome</th>
<th>OR (95% Confidence Intervals)</th>
<th>P-value&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-day mortality</td>
<td>7.725 (2.827-21.108)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Postoperative myocardial infarction</td>
<td>2.984 (1.272-7.003)</td>
<td>0.0120</td>
</tr>
<tr>
<td>Ventilator-dependent &gt;48 hours</td>
<td>5.630 (2.811-11.274)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>5.288 (2.045-13.672)</td>
<td>0.0006</td>
</tr>
<tr>
<td>Progressive renal insufficiency</td>
<td>11.898 (3.789-37.358)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Stroke</td>
<td>4.551 (1.558-13.290)</td>
<td>0.0056</td>
</tr>
<tr>
<td>Transfusion</td>
<td>3.539 (2.547-4.919)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>SSI</td>
<td>2.371 (1.242-4.526)</td>
<td>0.0088</td>
</tr>
<tr>
<td>Wound complications</td>
<td>3.047 (1.731-5.366)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Other infection</td>
<td>7.008 (3.465-14.176)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Return to OR</td>
<td>4.564 (2.158-9.655)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

<sup>a</sup> Multivariable logistic regression with stepwise selection at 0.05 level comparing hyperglycemia, age, diabetes, gender, priority, race, creatinine, BMI, smoking status, COPD history, and CHF history on each outcome.

<sup>b</sup> P-values generated using Wald test with chi-square test statistic
Table 4. Postoperative outcomes of patients with hyperglycemic events of glucose>180mg/dl stratified by diabetic status

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Total (N=366)</th>
<th>Non-diabetic (n=188)</th>
<th>Diabetic (n=178)</th>
<th>P-value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-day mortality</td>
<td>21</td>
<td>16 (8.5%)</td>
<td>5 (2.8%)</td>
<td>0.0191</td>
</tr>
<tr>
<td>Postop MI</td>
<td>16</td>
<td>6 (3.2%)</td>
<td>10 (5.6%)</td>
<td>0.2565</td>
</tr>
<tr>
<td>Vent &gt; 48 hours</td>
<td>31</td>
<td>25 (13.3%)</td>
<td>6 (3.4%)</td>
<td>0.0007</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>18</td>
<td>12 (6.4%)</td>
<td>6 (3.4%)</td>
<td>0.1829</td>
</tr>
<tr>
<td>Prog. Renal failure</td>
<td>14</td>
<td>13 (6.9%)</td>
<td>1 (0.6%)</td>
<td>0.0015</td>
</tr>
<tr>
<td>Postop stroke</td>
<td>11</td>
<td>6 (3.2%)</td>
<td>5 (2.8%)</td>
<td>0.8304</td>
</tr>
<tr>
<td>Transfusion</td>
<td>148</td>
<td>95 (50.5%)</td>
<td>53 (29.8%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Wound Complication&lt;sup&gt;b&lt;/sup&gt;</td>
<td>32</td>
<td>20 (10.6%)</td>
<td>12 (6.7%)</td>
<td>0.1871</td>
</tr>
<tr>
<td>Other infection&lt;sup&gt;d&lt;/sup&gt;</td>
<td>31</td>
<td>23 (12.2%)</td>
<td>8 (4.5%)</td>
<td>0.0079</td>
</tr>
<tr>
<td>Graft thrombosis</td>
<td>1</td>
<td>0 (0.0%)</td>
<td>1 (0.6%)</td>
<td>0.4863&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Return to OR</td>
<td>23</td>
<td>13 (6.9%)</td>
<td>10 (5.6%)</td>
<td>0.6093</td>
</tr>
<tr>
<td>Readmission</td>
<td>45</td>
<td>18 (9.6%)</td>
<td>27 (15.2%)</td>
<td>0.1033</td>
</tr>
</tbody>
</table>

<sup>a</sup> P-values generated using chi-square test of homogeneity

<sup>b</sup> Composite of wound dehiscence, hematoma, and SSI
Table 5. Postoperative outcomes in diabetic and non-diabetic patients stratified by hyperglycemic events of glucose>180mg/dl

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Diabetic (N=261)</th>
<th>Non-diabetic (N=790)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total (N=83)</td>
<td>Glucose&lt;180mg/dl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(N=178)</td>
</tr>
<tr>
<td>30-day mortality</td>
<td>6</td>
<td>1 (1.2%)</td>
</tr>
<tr>
<td>Postop MI</td>
<td>10</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Vent &gt; 48 hours</td>
<td>8</td>
<td>2 (2.4%)</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>7</td>
<td>1 (1.2%)</td>
</tr>
<tr>
<td>Prog. Renal failure</td>
<td>1</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Postop stroke</td>
<td>6</td>
<td>1 (1.2%)</td>
</tr>
<tr>
<td>Transfusion</td>
<td>66</td>
<td>13 (15.7%)</td>
</tr>
<tr>
<td>Wound Complication(^c)</td>
<td>12</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Other infection(^d)</td>
<td>9</td>
<td>1 (1.2%)</td>
</tr>
<tr>
<td>Graft thrombosis</td>
<td>1</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Return to OR</td>
<td>10</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Readmission</td>
<td>35</td>
<td>8 (9.6%)</td>
</tr>
</tbody>
</table>

\(^a\) P-values generated using chi-square test of homogeneity
\(^b\) P-values generated using Fisher’s exact test
\(^c\) Composite of wound dehiscence, hematoma, and SSI
\(^d\) Infection other than pneumonia or wound infection
Table 6. Outcomes predicted by hyperglycemia >180 mg/dl and/or hypoglycemia <70 mg/dl on stepwise multivariate logistic regression

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Hyperglycemia OR (95% Confidence Intervals)</th>
<th>P-value&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Hypoglycemia OR (95% Confidence Intervals)</th>
<th>P-value&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-day mortality</td>
<td>6.586 (2.373-18.278)</td>
<td>0.0003</td>
<td>3.294 (1.438-7.546)</td>
<td>0.0048</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>2.663 (1.118-6.347)</td>
<td>0.0270</td>
<td>1.856 (0.775-4.447)</td>
<td>0.1652</td>
</tr>
<tr>
<td>Ventilator-dependent &gt;48 hours</td>
<td>4.665 (2.301-9.457)</td>
<td>&lt;0.0001</td>
<td>2.931 (1.533-5.603)</td>
<td>0.0011</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>3.529 (1.324-9.403)</td>
<td>0.0117</td>
<td>8.186 (3.101-21.609)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Progressive renal insufficiency</td>
<td>7.788 (2.386-25.423)</td>
<td>0.0007</td>
<td>7.842 (2.657-23.144)</td>
<td>0.0002</td>
</tr>
<tr>
<td>Stroke</td>
<td>3.763 (1.251-11.321)</td>
<td>0.0184</td>
<td>2.517 (0.891-7.109)</td>
<td>0.0814</td>
</tr>
<tr>
<td>Transfusion</td>
<td>3.010 (2.146-4.223)</td>
<td>&lt;0.0001</td>
<td>2.604 (1.845-3.675)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Wound complications</td>
<td>2.337 (1.304-4.189)</td>
<td>0.0044</td>
<td>3.020 (1.726-5.285)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Other infection&lt;sup&gt;c&lt;/sup&gt;</td>
<td>5.798 (2.827-11.892)</td>
<td>&lt;0.0001</td>
<td>2.527 (1.318-4.846)</td>
<td>0.0053</td>
</tr>
<tr>
<td>Return to OR</td>
<td>3.870 (1.777-8.427)</td>
<td>0.0007</td>
<td>1.835 (0.860-3.914)</td>
<td>0.1163</td>
</tr>
<tr>
<td>Readmission</td>
<td>1.160 (0.718-1.875)</td>
<td>0.5443</td>
<td>2.124 (1.335-3.381)</td>
<td>0.0002</td>
</tr>
</tbody>
</table>

<sup>a</sup> Multivariable logistic regression with stepwise selection at 0.05 level comparing hyperglycemia, hypoglycemia, age, diabetes, gender, priority, race, creatinine, BMI, smoking status, COPD history, and CHF history on each outcome. If hyperglycemia or hypoglycemia was found to be not significant, it was forced into the model along with the selected variables.

<sup>b</sup> P-values generated using Wald test with chi-square test statistic

<sup>c</sup> Infection other than pneumonia or wound infection
Discussion/Conclusion

• This study demonstrates a correlation between perioperative glucose levels and post-operative outcomes in vascular patients.

• We show a strong association between poor post-operative glycemic control and 30-day mortality (both hyper- and hypoglycemia)
  – Hyperglycemia has a stronger association with 30-day mortality

• Hypoglycemia has stronger association with post-operative readmission, ARF, and wound complications
Future Thoughts/Endeavors

• Design prospective analysis
• Consider analysis for <120 mg/dl, 120 mg/dl to 180 mg/dl, and >180 mg/dl
• Analysis of cost and length of stay
• Need to obtain pre-operative Hgb A1c
• Proposed study that will use DPP-4 inhibitor pre-operatively (sitagliptin)