A Surgeon’s Perspective on PAD: New Surgical Techniques

Joseph M. Griffin
Andrew J. Olinde
Victor Q. Tran
M. Vince Weaver

Vascular Specialty Center
The leading-edge care, capabilities & experience doctors trust.

Total Vein Care
Complete, leading-edge solutions for effective relief.
Evolution of Vascular Surgery
(In my lifetime)

<table>
<thead>
<tr>
<th></th>
<th>1990</th>
<th>2016</th>
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<tr>
<td>Open Surgery</td>
<td>100%</td>
<td>40%</td>
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<td>Endovascular</td>
<td>0%</td>
<td>60%</td>
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<tr>
<td>Intervention</td>
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<tr>
<td>Intervention</td>
<td>2005</td>
<td>2013</td>
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<td>Coronary Artery Endovascular Revascularization</td>
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<td>Peripheral Artery Endovascular Revascularization</td>
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<td>Peripheral Vein Revascularization</td>
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<td>Vein Ablation</td>
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<td>Lower Extremity Bypass</td>
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<td>Lower Extremity Amputation (All Cases)</td>
<td>124,558</td>
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<tr>
<td>Major Lower Extremity Amputation (Above and Below Knee)</td>
<td>54,778</td>
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Hybrid OR
Left Leg Angiography

Nitroglycerin
Left Leg Angiography
Hybrid Procedure

Left Femoral to Above Knee Popliteal Bypass with PTFE with on-table atherectomy and angioplasty of Anterior Tibial Artery
Hybrid Procedure

Left Femoral to Above Knee Popliteal Bypass with PTFE with on-table atherectomy and angioplasty of Anterior Tibial Artery
Topics to Cover

• Abdominal Aortic Aneurysms (AAA)
• Peripheral Arterial Disease (PAD)
• Carotid Disease
• Vein Disease
Abdominal Aortic Aneurysm

• The Problem
  • Ruptured AAA – 15,000 deaths a year
    • May be as high as 30,000
  • Operative mortality > 50%
  • Overall mortality 90%
  • Preventable

• Definition
  • Focal dilatation > 50% normal diameter
    • 3cm in the abdominal aorta
  • Infrarenal Aorta is the most common site of aneurysm formation
  • Male to female ratio of 4:1
Natural History

• Risk of AAA Rupture at 5 years
  • 5-5.9 cm (25%)
  • 6-6.9 cm (35%)
  • 7cm or larger (75%)

• Most AAA expand at a rate of 2-4mm/year
Open Repair

• Proximal and distal control
• Opening of the aneurysmal sac
• Implanting a graft in to exclude the disease segment
Disadvantages of Open Repair

- Longer hospital stay
- Longer ICU stay
- More blood transfusions
- Increased morbidity and mortality
- Higher rate of discharge to nursing home & delayed return to normal activities
Endovascular Repair

• Transfemoral insertion of a stent graft.
• Relining of the diseased segment.
• Multiple different devices and configurations
  • All require seal zone and adequate access vessels.
Endovascular AAA System

Main Body

Proximal Extension

Vela Marker
Ct Study Images
Pre-case

Angiogram Image
Post-case
Fenestrated AAA Endovascular Graft

• Unique graft created to provide an endovascular repair option for patients with a length of aorta above the aneurysm that is too short to form a seal using a standard (non-fenestrated) endovascular graft.

• Specially made in Australia for each patient.
Peripheral Arterial Disease (PAD)

• Affects about 8 million Americans and is associated with significant morbidity and mortality.
• Affects 12-20% of Americans ages 65 and older.
• Only 25% of PAD patients are undergoing treatment.
• Marker for systemic atherosclerotic disease. Persons with PAD, compared to those without, have four to five times the risk of dying of a cardiovascular event, resulting in a two to three times higher total mortality risk.
• African-American ethnicity is a strong and independent risk factor for PAD. African-Americans have a higher PAD prevalence than non-Hispanic whites.
Endovascular Interventions

- POBA (Plain Old Balloon Angioplasty)
- DCB (Drug Coated Balloon)
- Stenting
- Atherectomy
Critical Limb Ischemia – 6 months

- Alive without amputation: 40%
- Alive with amputation: 40%
- Dead: 20%
So why not bypasses for everyone?

- Surgical Complications aside from thrombosis or restenosis:
  - Wound dehiscense (10% to 14%)
  - Wound infection (10% to 14%)
  - Bleeding (4% to 5%)
  - Graft infection (2% to 3%)
  - Lymphocele (2%)
Another good reason to prefer endovascular surgery...

...and why patients prefer it as well
The Society for Vascular Surgery Lower Extremity Threatened Limb Classification System: Risk stratification based on Wound, Ischemia, and foot Infection (WIfI)

Joseph L. Mills, Sr, MD, a Michael S. Conte, MD, b David G. Armstrong, DPM, MD, PhD, a Frank B. Pomposelli, MD, c Andres Schanzer, MD, d Anton N. Sidawy, MD, MPH, e and George Andros, MD, f on behalf of the Society for Vascular Surgery Lower Extremity Guidelines Committee, Tucson, Ariz; San Francisco and Van Nuys, Calif; Brighton and Worcester, Mass; and Washington, D.C.

- **Wound**: extent and depth
- **Ischemia**: perfusion/flow
- **Foot Infection**: presence and extent

Excluded: acute limb ischemia, emboli/"trash foot", trauma, vasculitides, pure venous ulcers, neoplastic disease, radiation

*J Vasc Surg 2014; 59(1) 220-34*
<table>
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<th>Risk of amputation</th>
<th>Proposed clinical stages</th>
<th>W/f spectrum score</th>
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<td>High</td>
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- **Stage 1**
  - Minimal ischemia; no/minor TL
  - Not in strict “CLI” definition
- **Stage 2**
  - Stage 1 with more infection
  - Rest pain without infection
  - Minor tissue loss/mod infection
- **Stage 3**
  - Range of tissue loss/ischemia
  - Mild to mod infection
- **Stage 4**
  - Advanced in one or more categories
- **Stage 5 is an unsalvageable foot**

Major Challenging Risk Factors

• Smoking
• Diabetes
• Renal Failure
Selecting the Optimal Revascularization Strategy

- **ASSESS PATIENT RISK**
  - Perioperative and long-term survival
  - Average risk: <5% op mortality, >70% 2 yr survival

- **ASSESS LIMB SEVERITY**
  - SVS Threatened Limb (WIfl) Stage

- **ASSESS ANATOMIC PATTERN OF DISEASE**
  - Endo: Likelihood of technical success and of patency
  - Bypass: Quality of available vein and target artery
Who benefits more from Open Bypass?

• More severe limb threat
• Multilevel severe disease
• Long occlusions
• Severe common femoral artery/trifurcation disease
• Adequate vein available
• Runoff to foot intact
Prior failed ipsilateral percutaneous endovascular intervention in patients with critical limb ischemia predicts poor outcome after lower extremity bypass

(J Vasc Surg 2011;54:730-6.)

Brian W. Nolan, MD, MS, Randall R. De Martino, MD, David H. Stone, MD, Andres Schanzer, MD, Philip P. Goodney, MD, MS, Daniel W. Walsh, MD, and Jack L. Cronenwett, MD, for the Vascular Study Group of New England, Lebanon, NH, and Worcester, Mass

VSGNE 1880 lower extremity bypasses

Fig. 3. Freedom from major adverse limb events after lower extremity bypass. Major adverse limb event includes amputation, graft occlusion, or reintervention. PVI, Peripheral vascular intervention.
CLASS IIa

1. **2011 New Recommendation:** For patients with limb-threatening lower extremity ischemia and an estimated life expectancy of 2 years or less in patients in whom an autogenous vein conduit is not available, balloon angioplasty is reasonable to perform when possible as the initial procedure to improve distal blood flow. *(Level of Evidence: B)*

2. **2011 New Recommendation:** For patients with limb-threatening ischemia and an estimated life expectancy of more than 2 years, bypass surgery, when possible and when an autogenous vein conduit is available, is reasonable to perform as the initial treatment to improve distal blood flow. *(Level of Evidence: B)*
Technology!
Pre Angiograms

Post Main Body

Post External Iliac Stent
Carotid Disease

- Stroke is the 3rd leading cause of death in the USA
- 600,000 new or recurrent cases per year with initial mortality of 15% to 30% and 5 year overall mortality of 50%.
- Survivors have 6% to 12% per year of subsequent stroke.
- Leading cause of death in extracranial occlusive disease is MI, however it is stroke in survivors.
Carotid Stenosis

Symptomatic
- Transient ischemic attacks
- Amaurosis fugax
- Completed or stroke-in-evolution
- NOT vertigo/syncope

Asymptomatic
- Asymptomatic
- Carotid Bruit
North American Symptomatic Carotid Endarterectomy Trial (NASCET)

CEA reduces stroke in symptomatic carotid stenosis.

- Randomized patients with symptomatic 30% to 99% between medical therapy versus CEA.
  - Surgery group stratified into severe (70% to 90%), moderate (50% to 69%), and mild (30% to 49%).
- Randomization of severe group halted because of clear benefit of CEA with 2-year incidence of ipsilateral fatal stroke and nonfatal at 9% compared to 26% in the medical group.
Best Medical Therapy for Carotid Disease 2016

- Lifestyle modification
- Smoking cessation
- Diet
- Obesity
- exercise

- Blood pressure control
- Statins
- ASA / Plavix
- Anticoagulation(atrial fib)
- Diabetes management
<table>
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<tr>
<th></th>
<th>CAS</th>
<th>CEA</th>
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<tr>
<td>Composite Outcome</td>
<td>5.2%</td>
<td>4.5%</td>
<td>.38</td>
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<tr>
<td>** CVA</td>
<td>4.1%</td>
<td>2.3%</td>
<td>.01</td>
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<tr>
<td>** MI</td>
<td>1.1%</td>
<td>2.3%</td>
<td>.03</td>
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<tr>
<td>Death</td>
<td>0.7%</td>
<td>0.3%</td>
<td>.18</td>
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<tr>
<td>CVA/Death</td>
<td>4.8%</td>
<td>2.6%</td>
<td>.005</td>
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Though it appears that the increased risk of stroke with carotid-artery stenting is offset by an increased risk of myocardial infarction with carotid endarterectomy, stroke has greater long-term health consequences than myocardial infarction. The risk–benefit issue is complex and
Carotid Endarterectomy

• Gold standard for asymptomatic critical (>80%) internal carotid artery stenosis

• Surgeon’s stroke rate ≤ 1.5% in 2016
Interventional Treatment

• Carotid angioplasty and stenting with distal embolization devices

• Indications:
  • Previous carotid surgery
  • Head and neck radiation therapy
  • Uncontrolled hypertension and/or diabetes
  • Severe COPD
  • Uncompensated congestive heart failure
Ongoing CREST 2 Trial may further define treatment of asymptomatic patients with carotid occlusive disease
New DVT Treatment Guidelines

- Anticoagulation alone is not enough
- Thrombolysis now recognized as a valid approach to treating DVT
- Requires hospitals to have evidence-based thrombolysis protocol\(^2\)
- ACCP suggests use of Pharmacomechanical Thrombolysis
  - Isolated Pharmacomechanical Thrombolysis lowest bleed rate
Pharmacomechanical Thrombolysis
Venous Compression Syndromes

• **Paget-Schroetter Syndrome** (Thoracic Outlet Syndrome, Effort Thrombosis): chronic compression of subclavian vein in costo-clavicular triangle, at the level of thoracic outlet ⁴.

• **May-Thurner Syndrome** (Iliac Venous Compression Syndrome): first described by Virchow in 1851, describes chronic compression of the left common iliac vein between the sacrum/vertebrae and the right common iliac artery ⁴.
Thrombosis Ilio-femoral vein extending into IVC treated with ultrasound assisted thrombolysis
Patient treated with tPA at 1mg/hr for 24 hours. Follow up venogram shows brisk flow in femoral veins and occlusive disease in the iliac veins.
Completion venogram shows widely patent ilio-femoral system with brisk flow
IVUS
Bilateral Iliac vein ± IVC obstruction
Femoro-caval PTFE bypass
CONCLUSION

The collaboration of all vascular specialists as a team provide the best medical care for our community