ENDOSCOPIC SAPHENOUS VEIN HARVESTING
aka
EVH, Endo-vein, Endoscopic vessel harvesting
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Objectives:
Understand the importance of preoperative lower extremity evaluation
Ultrasound imaging to determine satisfactory venous conduit
Identify 3 Techniques of Endoscopic Vein Harvesting
Identify the benefits of Endoscopic Vein Harvesting

No Disclosures
**Types of conduit used in past**

- **Definition:** Conduit - A natural or artificial channel through which water or fluid (blood) is conveyed
- **Conduit used to create bypasses**

<table>
<thead>
<tr>
<th>Conduit</th>
<th>Antilogous</th>
<th>Venous conduit</th>
<th>Arterial Conduit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Long Saphenous Vein (LSV)</strong></td>
<td></td>
<td><strong>Internal Mammary Artery (IMA)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Short Saphenous Vein (SSV)</strong></td>
<td></td>
<td><strong>Radial Artery</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Arm Vein (Cephalic and Brachial veins)</strong></td>
<td></td>
<td><strong>Others - Right Gastroepiploic Artery (RGEA), Inferior Epigastric Artery (IEA), Splanic Artery, Gastroduodenal Artery, Left Gastros, Ary Artery, and Interosseous Artery</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Greater Saphenous Vein</strong></td>
<td><strong>Lesser Saphenous Vein</strong></td>
<td><strong>None</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Vein grafts</strong></td>
<td><strong>Polytetrafluoroethylene (PTFE)</strong></td>
<td><strong>None</strong></td>
</tr>
</tbody>
</table>

Table 1

**Most common conduit(s) presently used:**

- **Arterial:**
  1. **Internal Mammary Artery** - Left most common
  2. Right or Left Radial Artery
- **Venous:**
  1. Greater Saphenous Vein
  2. Lesser Saphenous Vein
Internal Mammary Artery
- Located under lateral sternum
- Easily accessible when chest open
- Left internal mammary artery most commonly used in CAB
- Superior patency rate

Radial Artery
- Travels down the radial side of the forearm to the wrist
- Provides arterial conduit
- Arterial Studies – demonstrate patency of radial, ulnar & palmar arch
Greater Saphenous Vein

• Major superficial vein of the medial leg and thigh
• Longest vein in the body
• Used in several medical procedures due to its size and superficial location

Lesser Saphenous Vein

• Begins lateral portion of foot traverses up the back of the leg to the popliteal space
• Alternative choice of conduit if GSV not available
Endoscope – an instrument for visually examining the interior of a bodily canal

- "Harvesting" or removal of healthy blood vessel, either from the leg or arm, to use as a graft in coronary artery bypass (CABG), or peripheral bypass surgery, to restore or improve blood flow to the heart or lower extremity.
- Endoscopically harvested grafts are removed through a small, 2 cm incision.

History of Clinical Use of EVH

Endoscopic Vein Harvesting is the standard of care for Vessel harvesting in the majority of heart hospitals in the U.S.

U.S. EVH ADOPTION AND PENETRATION

Note: User Adoption data not available for 1987-1990 period
Source: CDC National Hospital Discharge Survey
Pre-operative Preparation

- Review history & physical findings w/ patient looking for contraindications or issues
  1. Varicosities of GSV
  2. Venous stripping / prior SVH
  3. Prior Trauma - potential injury to vein
  4. Prior thrombosis – DVT or Superficial thrombus
  5. Peripheral vascular disease
  6. Ulcerations

Varicosities of the Greater Saphenous Vein
Vein Stripping

- Vein Stripping - Look for multiple small scars over medial lower extremity
- Prior SVH - Look for longitudinal scar or transverse scar

Prior Trauma to Lower Extremity
DVT or Thrombosis of Greater Saphenous Vein

- Diagnosed with ultrasound
  - Thickened vessel wall
  - Clot

Peripheral Arterial Disease (PAD)

- Symptoms of claudication
- Decreased DP & PT Pulses
- Non-healing ulcers

**Measurements**

<table>
<thead>
<tr>
<th>Artery</th>
<th>Right Pressure/Ratio</th>
<th>Units</th>
<th>Left Pressure/Ratio</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brachial</td>
<td>135</td>
<td>mmHg</td>
<td>147</td>
<td>mmHg</td>
</tr>
<tr>
<td>Dorsalis Pedis (Ankle)</td>
<td>62</td>
<td>mmHg</td>
<td>Dorsalis Pedis (Ankle)</td>
<td>141</td>
</tr>
<tr>
<td>Posterior Tibial (Ankle)</td>
<td>90</td>
<td>mmHg</td>
<td>Posterior Tibial (Ankle)</td>
<td>157</td>
</tr>
<tr>
<td>ABI</td>
<td>0.58</td>
<td>ratio</td>
<td>ABI</td>
<td>1.02</td>
</tr>
</tbody>
</table>
Ulcerations / Brawny skin changes

- Indicate underlying venous insufficiency
- Can cause infection
- Areas of brawny skin changes don’t heal as well.

Techniques of GSV Harvesting

- **Open**
  - Single 30 – 45 cm longitudinal incision
  - Previously the traditional method of removing the Greater Saphenous Vein for CABG Surgery

- **Bridging**
  - Multiple smaller incisions

- **Endoscopic**
  - Single 2 cm incision
Ultrasounding GSV in OR

Initial Dissection
Control tower

Creating Tunnel with dissection and CO2 insufflation
Initial Dissection

Creation and extension of tunnel with dissection and insufflation

Tunnel insufflated with CO2

Inspection of tunnel and venous anatomy
Cauterizing Branches

Stab & Grab
Cannulation of vein
Reversal of Vein Graft

Normal Vein with Correctly Working Valves and Blood Flow

Valves open to allow blood to move up towards the heart and then close, preventing blood from flowing back down the leg again.
Challenges During EVH

- Bleeding in tunnel
- CO2 Embolus (OOPS!)
- Fat obscures vision
- Avulsion – common in superficial veins
- CO2 runs out – tunnel collapses

Quality of Conduit

- Maintaining endothelial integrity
  - Minimizing intravascular pressure
  - Minimizing traction
- Avulsions
  - Cautious dissection
  - Experienced harvester
- Retained Clots
  - Flush

Bershinsky, JM et al. Endoscopic Vessel Harvesting using advancement and best practices to enhance conduit quality
Vein wall Layers

Venous Wall Layers

EVH VS OVH for conduit quality

**EQUIVALENT EVH CONDUIT QUALITY**
- Atraii et al. JSLS 2001;5(1):37-45

**SAPHENOUS VEIN GRAFT QUALITY IN EVH VS. OVH**

**NON-EQUIVALENT EVH CONDUIT QUALITY**
Risk factors for Saphenous Vein Harvest Wound Complications

- Women
- Diabetes
- Smoking
- PAD
- Obesity
- Lower pre-op hematocrit levels
- Use of IABP
To avoid wound complications

- Extremity & Vascular evaluation preoperatively
- Operative technique
- Careful harvest site selection

Thigh Wound Complication


EVH Benefits in Diabetic Patients

Reduction of Wound Related Care with EVH


EVH Reduces PostOperative Pain


EVH Facilitates Earlier Patient Mobility


EVH Reduces Hospital Stay

Benefits of EVH

- Equivalent conduit quality and graft patency
- Reduced wound complications and infections
- Reduced wound-related postoperative care and readmissions
- Reduced postoperative pain
- Reduced time to ambulation and reduced length of stay
- Improved cosmesis
VirtuoSaph
Endoscopic Skin Ablation System
Unique Technology Worth a Closer Look

Sorin
VascuClear
References

Sean Bello, SSCTS Tomorrow’s Cardiothoracic Surgeons: Table 1
Maquet Topics in Endoscopic Vessel Harvesting pg. 3
Innerbody.com
Accessmedicine.ahmed.com
T. Treadwell, Management of Saphenous Vein Harvest Wound Complications following CARG, Medscape Multispecialty, Wounds 2003;15(3)