THE ART OF OPEN VENOUS RECONSTRUCTIONS IN THE ENDOVASCULAR ERA

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DEPARTMENT OF SURGERY GRAND ROUNDS
April 12, 2017
Disclosure

I have no personal or professional financial relationships or interests with any proprietary entity producing healthcare goods/or services.
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Kenneth J. Cherry, MD
Drs. Hollier, Cherry, Gloviczki, Hallett, Pairolero
Section of Vascular Surgery, Mayo Clinic, 1987
Mayo Clinic Door Card

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You are cordially invited to attend a
Reception and Dinner
Honoring the Fourth Larry H. Hollier Visiting Professor
of the Division of Vascular and Endovascular Surgery

Doctor and Mrs. Kenneth J. Cherry, Jr.

Time:  7:00 p.m. Reception, 7:45 p.m. Dinner

After Dinner Presentation
“The Italian Campaign 1943 - 1945”

Date:  Friday, August 27, 2010

Place:  Mayo Foundation House

Black Tie

Please RSVP to Marcia Simonson by August 20, 2010 at
507-284-3407 or simonson.marcia@mayo.edu
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Please RSVP to Martha
507-284-3407
THE ART OF OPEN VENOUS RECONSTRUCTIONS IN THE ENDOVASCULAR ERA

DEPARTMENT OF SURGERY GRAND ROUNDS
April 12, 2017
ACUTE VENOUS THROMBOEMBOLISM (DVT + PE)

• Occurs as often as stroke (1 per 1000/year)
• Death due to PE: ~100,000/year
• 30% have recurrence
• 28% to 43% will develop post-thrombotic syndrome

CHRONIC VENOUS DISEASES

• 25 to 40 million Americans have varicose veins or more advanced chronic venous insufficiency

• 500,000 to 1 million have venous ulcers
VEIN CARE HAS CHANGED FOREVER!
Venous Interventions

• Superficial venous disease is treated with percutaneous techniques in the office
SAPHENOUS VEIN ANEURYSM

ACCESSORY SAPHENOUS VEIN ANEURYSM
KLIPPEL-TRENAUNAY SYNDROME
Venous Interventions

- Deep venous disease, acute or chronic, in many patients are treated with endovenous interventions
Stents

A

B

CP951387-8
Non-thrombotic obstruction of the iliac veins

May – Thurner Syndrome
May – Thurner Syndrome

Wallstent
Boston Scientific
Marlborough, MA
Stenting of the venous outflow in chronic venous disease: Long-term stent-related outcome, clinical, and hemodynamic result

Peter Neplén, MD, PhD, Kathryn C. Hollis, BA, Jake Olivier, PhD, and Seshadri Raju, MD,
Jackson, Miss

Background: Stenting of chronic nonmalignant venous disease is now available to perform long-term and effective intervention.

Materials: From 1997 to 2005, 982 chronic venous ulcerations treated under intravascular ultrasound guidance. Median age: 61 years, 2:6:1, and left/right limb symptoms, 2:4:1. Chronic venous primary/secondary etiology was 518:464. Treatment options were recurrent stenosis, clinical outcome, quality of life, and CIVIQ Questionnaire (CIVIQ), and hemodynamics.

Result: Monitoring for 94% of patients lasted no mortality (<30 days) and low morbidity, (days) and during later follow-up (3%). At 72 months, were 79%, 100%, and 100% in nonthrombotic limbs. Cumulative rate of severe in-stent restenosis (mild to moderate) in nonthrombotic limbs). The main risk factor for chronic venous thrombosis by itself was significantly poststenosis. Severe leg pain (visual analog scale: 62% present to 18% poststent, respectively, and ulcer healing categories. Mean hand-foot pressure difference in nonthrombotic limbs with no concomitant reflux. The hemodynamic reflux in subsets of patients with a reflux index >1.

Conclusions: Venous stenting can be performed with a low rate of in-stent restenosis. It resulted in major clinical improvement, consistently reflected in any substantial hemodynamic improvement and clinical outcome occurred regardless of presence of chronic venous ulceration. (J Vasc Surg 2007;46:979-90.)
Venous Interventions

• Open surgery is used for those who are not candidates for or fail endovenous procedure
Indications for Open or Hybrid Venous Reconstructions

1. Venous Aneurysms

2. Chronic Venous Obstructions
   1. Congenital agenesis or aplasia
   2. Venous compression syndromes
      1. May – Thurner Syndrome
      2. Nutcracker Syndrome
      3. Entrapment syndromes (popliteal, femoral)
      4. Paget - Schroetter Syndrome
   3. Post-thrombotic syndrome
   4. Mediastinal or retroperitoneal fibrosis
   5. Central lines, pacemakers
   6. Tumor
   7. Trauma

3. Valve incompetence
Indications for Open or Hybrid Venous Reconstructions

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   6. Tumor
   7. Trauma
   3. Valve incompetence
Popliteal Vein Aneurysm
Popliteal Arteriovenous Fistula with Venous Aneurysm

22 year old male with painful and pulsatile mass of right knee, swelling and thrill following arthroscopic surgery.
PORTAL VEIN ANEURYSM
May-Husni Procedure
Post-Thrombotic Syndrome in the TULIPA Registry
RCT in Compression Therapy for Lymphedema
PE in Isolated Calf Vein Thrombosis
Venous Insufficiency in Patients with Absent IVC
Outcomes of Sapheno-Popliteal Vein Bypass
Venous Practice of Vascular Surgeons
Contemporary Results Following Saphenopopliteal Transposition For Chronic Femoral Vein Occlusion
D.M. Coleman, J.E. Rectenwald, F.C. Vandy, T.W. Wakefield, University of Michigan, Ann Arbor, Mich

Background: Chronic occlusion of the femoral or the proximal popliteal vein responsible for venous insufficiency and the constellation of clinical sequelae that ensue remains a surgical challenge that carries notable patient morbidity and the threat of potential limb loss. Saphenopopliteal bypass remains a surgical reconstructive option for select patients that demonstrate patency of the popliteal vein, greater saphenous vein, saphenofemoral junction and pelvic veins. We sought to analyze our single-institution experience with this technique.

Methods: A retrospective review of a single-center experience with saphenopopliteal transposition was performed. Preoperative risk factors and indications for intervention (ie: symptomatic venous insufficiency) were identified. Duration of follow-up and end-point, wound healing, patency and limb loss analysis for patency was performed.

Results: Seventeen patients underwent saphenopopliteal transposition for chronic lower extremity obstruction in 2011. Median age at operation was 40 years; a male predominance noted (N=12; 71%). Chronic edema and venous claudication. Sixteen patients had venous ulceration preoperatively. Seven patients had a concomitant arteriovenous fistula. Two patients underwent concomitant femoropopliteal vein bypass. Patients (29%) experienced hematoma positive evacuation; in two patients compression results in graft occlusion. After a median follow-up of 82%, 73% of patients experienced symptom improvement. Four of the six patients with wounds (67%). Of the sixteen patients that required amputation and there was a 96.3% primary patency rate exceeds any previously published rates.

Conclusions: Saphenopopliteal bypass improves symptoms of venous disease secondary to deep venous obstruction. A limb salvage surgical reconstruction option remains a satisfactory option and produces clinical improvement in a selected population considered in a contemporary venous surgical practice.
Iliac Vein Obstruction

Palma Procedure
Open surgical treatment

Palma Procedures
Factors affecting outcome of open and hybrid reconstructions for nonmalignant obstruction of iliofemoral veins and inferior vena cava

Nitin Garg, MBBS, MPH,a Peter Gloviczki, MD,a Kamran M. Karimi, MD,a Audra A. Duncan, MD,a Haraldur Bjarnason, MD,b Manju Kalra, MBBS,a Gustavo S. Oderich, MD,a and Thomas C. Bower, MD,a Rochester, Minn

Objectives: To identify factors affecting long-term outcome after open surgical reconstructions (OSR) and hybrid reconstructions (HR) for chronic venous obstructions.

Methods: Retrospective review of clinical data of 60 patients with 64 OSR or HR for chronic obstruction of iliofemoral (IF) veins or inferior vena cava (IVC) between January 1987 and June 2006 was performed. Sixty patients (26 men, mean age 43 years; 24 women, mean age 50 years) were studied. All underwent duplex scanning, phlebography, and venous lysis. Twenty-four patients underwent removal of aortic or iliac vein stents. The diagnosis was based on symptoms, clinical examination, and imaging studies. The follow-up period was at least 5 years. All patients were followed for a minimum of 5 years.

Results: Sixty patients (26 men, mean age 43 years; 24 women, mean age 50 years) were studied. Fifty-two OSRs included 29 femoropopliteal, 13 femoroiliac, and 10 iliac vein reconstructions. Forty-nine HRs included 27 femoropopliteal, 18 femoroiliac, and 4 iliac vein reconstructions. The mean follow-up period was 7.5 years. The primary patency rate was 96% after OSR, 92% after HR, and 78% after Palma vein grafts. The secondary patency rate was 42% after OSR, 49% after HR, and 65% after Palma vein grafts.

For Palma vein grafts it was 70% after OSR, 78% after HR, and 65% after Palma vein grafts. For femoropopliteal vein grafts it was 70% after OSR, 78% after HR, and 65% after Palma vein grafts. For femoropopliteal vein grafts it was 70% after OSR, 78% after HR, and 65% after Palma vein grafts.

Conclusions: Both OSR and HR are viable options for treatment of chronic venous obstructions. The cumulative patency of 25 Palma grafts is shown in the graph.

Cumulative Patency of 25 Palma Grafts

- 100% Patency
- 80% Patency
- 60% Patency
- 40% Patency

Number at risk

<table>
<thead>
<tr>
<th>Time (months)</th>
<th>Patency</th>
<th>Number at risk</th>
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<tr>
<td>120</td>
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</tbody>
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Palma graft 22 years after surgery
Iliac Vein Obstruction
Femoro-femoral PTFE bypass
Bilateral Iliac vein \( \pm \) IVC obstruction

Femoro-caval PTFE bypass
At 3 years
(patent at 13 years)

At 4.5 years

At 3 years
(patent at 9 years)
Extent of Thrombosis

$n = 8$ patients

$n = 2$  $n = 3$  $n = 1$  $n = 2$
Cumulative Secondary Patency

- Femoro-iliac/ilio-caval: 86%
- Palma vein: 78%
- Femorocaval: 57%

Number at risk:
- Femoro-iliac/ilio-caval: 25 (13), Palma vein: 10 (4), Short bypass: 8 (4), Femorocaval: 9 (6)
Outcomes of 102 patients treated with segmental inferior vena cava resection and graft replacement for malignant disease

Thomas C. Bower MD, Bernardo C. Mendes MD, Barbara J. Toomey RN, Peter Gloviczki MD, Stephen Cha MS, Audra A. Duncan MD, Manju Kalra MBBS, Gustavo S. Oderich MD, Mark D. Fleming MD, Randall R. De Martino MD, Kenneth J. Cherry MD and David M. Nagorney MD

Division of Vascular and Endovascular Surgery, Department of Epidemiology and Biostatistics, Division of Subspecialty General Surgery, Mayo Clinic, Rochester and Division of Vascular Surgery, University of Virginia

J Vasc Surg 2014;59:36S
Primary Leiomyosarcoma of IVC

Tumor resection + IVC & renal vein replacement with PTFE Graft
Bovine Pericardial Patch
IVC

Caudate Lobe
COMPLICATIONS OF ENDOVASCULAR TREATMENT
Open surgical removal of iliac vein Wallstents with excision of pseudointima obstructing the contralateral iliac vein

Animesh Rathore, MD, Peter Gloviczki, MD, and Haraldur Bjarnason, MD, Rochester, Minn

Persistent pain after iliac vein stenting is rare. Surgical removal of two oversized (20-mm) iliac vein stents was performed in a 36-year-old woman because of severe back pain of 2½ years’ duration. Clamping or venotomy were not required for stent removal, which was done by extraction of each wire of the vein wall. Duplex scanning confirmed residual pseudointima obstructing pseudointima was surgically removed. The patient recovered without complication. (Vasc Surg: Venous and Lym Dis 2016;4:525-9.)
36 y/o female 2½ year after left iliac vein stenting with back pain, left hip and thigh pain
Right common iliac artery

Left common iliac vein stent
Nutcracker Syndrome

Aorta

SMA

LRV
Stent Complications

- Stent fracture, +/- residual stenosis
- Stent migration (IVC, Heart, Lung)
- Maldeployment, with kink of renal vein
Stent complication

Endovenous removal of dislodged left renal vein stent in a patient with nutcracker syndrome

Muhammad A. Rana, Gustavo S. Oderich*, and Haraldur Bjarnason

Division of Vascular and Endovascular Surgery, Mayo Clinic, 200 First Street SW, Rochester, MN 55905
Operative Technique

Saphenous vein cuff

Saphenous vein patch
Superior Vena Cava Syndrome
SVC Syndrome
Grafts For SVC and Innominate Vein Reconstruction

Spiral Saphenous Vein

Femoral Vein

PTFE
Reconstruction for SVC and Innominate Vein obstruction

- Spiral SVG
- Femoral vein
- ePTFE
Results of 44 open reconstructions for SVC syndrome

- Femoral vein
- Spiral vein graft
- ePTFE

Follow-up time (year)

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<td>5</td>
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p = 0.29
Conclusions

Open Surgical Reconstruction of Large Veins

• Is effective and durable

• Remains an excellent option in patients who are unsuitable for or fail endovascular repair
Treatment of Venous Disease

- Open Venous Surgery
- Phlebologists
- Interventional Radiologists
- Dermatologists
- Interventional Cardiologists
- General practitioners
- Vascular Medicine Physicians
- Plastic Surgeons
- Cardiac surgeons
- General surgeons
- Vascular Surgeons
- Dermatologists
- Interventional Cardiologists
- General surgeons
- Vascular Surgeons
OPEN VENOUS RECONSTRUCTIONS ARE IMPORTANT IN THE ENDOVASCULAR ERA
OPEN VENOUS RECONSTRUCTIONS ARE IMPORTANT IN THE ENDOVASCULAR ERA

Learn Them!

Do Them!

Teach Them!
THANK YOU!
Mayo Clinic
Gonda Vascular Center