MINIMALLY-INVASIVE TREATMENT OF VASCULAR DISEASE

The Section of Vascular Surgery at Dartmouth-Hitchcock Medical Center is committed to outstanding care of patients with vascular disease, research to advance this care, and the education of practitioners. By combining our research efforts with medical, endovascular and surgical therapies, we provide the most advanced treatments for vascular diseases.

Our approach is conservative, emphasizing preventive measures, risk factor reduction and medical treatment when possible. However, vascular disease can be life threatening, and as surgeons who have developed advanced interventional skills, we can evaluate each patient to determine whether newer less invasive interventional treatment, or open surgical treatment, is more appropriate. In this profile, we provide an overview of services available in our clinical practice.
TRANSFORMING MEDICINE

Helped pioneer the most accurate way to image and plan for aortic aneurysm stent-graft therapy, also known as endovascular aneurysm repair. We collaborated with Medical Media Systems, Inc. to design and develop the most sophisticated three-dimensional treatment planning software in the world. We have the largest series in the literature for endovascular repair of abdominal aortic aneurysm with noninvasive preoperative imaging, with excellent clinical results.
OVERVIEW

With the growing number of elderly patients in the United States, the prevalence of all forms of vascular disease is increasing significantly. Unhealthy habits such as smoking, sedentary lifestyles and poor nutrition also are major contributors to this rise. Preventing or delaying the onset of vascular disease by risk factor modification is imperative in improving the health and well being of our patients, and is a prerequisite to more invasive treatment when symptoms develop.

Major advances in technology have made it possible to improve the quality of life for patients with vascular disease. Noninvasive diagnostic tests, such as Duplex ultrasound, enable vascular surgeons to diagnose disease in its earliest stages, thus reducing the risk for serious complications. Minimally-invasive treatments using angioplasty and stents often enable surgeons to treat the diseased arteries without the risk of larger open operations that were often required in the past.

The Section of Vascular Surgery at Dartmouth-Hitchcock Medical Center is nationally and internationally recognized for advancing the diagnosis and treatment of vascular disease, from the simple to the most complex forms. We are one of a select group of academic medical centers involved in clinical research trials sponsored by the National Institutes of Health, the FDA, and other organizations and corporations. Because of this research, we are able to offer many exciting new treatments for vascular disease. The Section of Vascular Surgery is also home to the Journal of Vascular Surgery, providing vascular surgeons, cardiothoracic surgeons and other vascular specialists nationwide with the latest information about vascular disease, diagnosis, treatment and research.

Research highlights:

- Helped organize and spearhead a data registry of surgical outcomes for vascular procedures in Northern New England.
- Reported important clinical results related to minimally-invasive technology for carotid, renal, visceral vessel and lower extremity arterial occlusive disease.
- At the forefront of combining less invasive interventional techniques with open surgery in order to lessen the extent and invasiveness of the open surgical procedure.
- Reported research discoveries on important factors related to aneurysm rupture risk including gender, blood pressure and smoking.
- Pioneered noninvasive imaging techniques for carotid, renal and mesenteric occlusive disease using duplex ultrasound.

TRANSFORMING MEDICINE

Helped pioneer lower extremity bypasses performed without arteriography.
STATE OF THE ART VASCULAR DIAGNOSTIC LABORATORY

The Vascular Laboratory is accredited by the Intersocietal Commission on the Accreditation of Vascular Laboratories (ICAVL) and has the largest patient volume of any vascular laboratory in New Hampshire and Vermont. State-of-the-art digitized ultrasound technologies are used to non-invasively diagnose vascular disease throughout the body. Non-invasive diagnostics allow for the examination of patients without the risks and discomforts of injections or other invasive procedures. The DHMC Vascular Laboratory is among only ten percent of laboratories in the United States which are approved to perform intracranial, extra-cranial, cerebrovascular, lower extremity, and abdominal (aortic, mesenteric and renal) arterial examinations as well as venous studies.

WORKING TOGETHER WITH YOU

We are committed to working closely with referring physicians to ensure that patients receive the best treatment. This includes communication about any necessary pre-operative preparation as well as post-operative or post-interventional follow-ups. Patients with potential vascular problems are seen in whatever time frame is deemed appropriate by the referring physician. A vascular surgeon is available twenty four hours a day for telephone consultation.

We will do our best to send you patient status and other information in the method you prefer. Patient notes are available online or they can be mailed or emailed the day of the consultation. We believe that close coordination of a patient’s workup, cardiovascular risk factor reduction, and post-operative care with the referring physician, is required to achieve optimal outcomes in this critically ill patient population.

VASCULAR DISEASES

The major diseases which are best cared for by board certified vascular surgeons include diseases of the aorta such as aneurysm; carotid artery occlusive disease, which can cause stroke; peripheral vascular occlusive disease, which causes patients to suffer problems walking to the point where their limbs may be threatened; renal vascular disease, which may threaten the function of the kidneys or cause severe hypertension; mesenteric vascular disease affecting the bowel and which can be life threatening; and venous disease, which can range from cosmetically troublesome spider veins to painful varicose veins and even severe venous insufficiency leading to ulceration of the skin about the ankle.

TRANSFORMING MEDICINE

Developed a new technique to estimate aortic aneurysm rupture risk by measuring aneurysm wall stress. This research has been sponsored in part by the National Institutes of Health and the National Heart, Lung and Blood Institute, and has been performed in collaboration with the Thayer School of Engineering at Dartmouth. This new technique provides a better method of estimating which patients need aneurysm repair and which patients are at low risk and may not need repair.
Aortic Aneurysms

The Section of Vascular Surgery is a leader in the effort to develop new approaches to aneurysm repair using less invasive techniques called **endovascular repair**. These techniques, which use a stent-graft to exclude the aneurysm, allow for a shorter hospital stay, reduced risk of complications and an easier recovery for the patient. DHMC has access to the latest device technology for thoracic and abdominal aortic aneurysms through FDA-controlled clinical trials, which are predominantly conducted at 30-40 centers nationwide. Not every patient, however, can be treated successfully with this technique. To determine if a patient is an appropriate candidate for endovascular treatment, we evaluate the aneurysm size, location and shape as well as the patient’s age, health status, vascular anatomy and presence of co-morbidities.

Our short and long term results using endovascular treatment for aortic aneurysms are among the best reported in the world. We attribute much of this to sophisticated three-dimensional imaging, which we helped pioneer. This imaging is noninvasive, based on CT scan or magnetic resonance scans, and eliminates the need for arterial punctures and arteriograms just to see if a patient is a candidate for endovascular repair.

Taking this technology even further, we have also developed three-dimensional aortic aneurysm wall stress analysis. We have demonstrated this to be a more accurate method of estimating aneurysm rupture risk than aneurysm diameter.
Vascular Surgery continues to be the primary discipline for the diagnosis and treatment of extracranial cerebral vascular disease and the prevention of stroke. To obtain an accurate diagnosis and anatomic detail of the extra and intracranial circulation, we use noninvasive imaging including duplex ultrasound, magnetic resonance angiography (MRA), or CT angiography. Depending on the patient’s age, symptomatic status and severity of disease, we will suggest either observation or intervention.

While carotid endarterectomy historically has been the most commonly performed intervention, less invasive carotid stenting has recently become a possible treatment option for selected patients. As of January 2005, the Section of Vascular Surgery has treated more than 150 high-risk patients using stents and the results have surpassed expectations. Despite the patients high risk status, the results have been comparable to those achieved with carotid endarterectomy. With both surgical and minimally-invasive modalities, we are able to boast one of the lowest peri-operative complication rates in the world.

Comparison of Carotid Endarterectomy and stent
Dartmouth Experience (2000-2004)

<table>
<thead>
<tr>
<th></th>
<th>Endarterectomy</th>
<th>Stent</th>
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</thead>
<tbody>
<tr>
<td>Number</td>
<td>266</td>
<td>74</td>
</tr>
<tr>
<td>Stroke</td>
<td>0.5%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>4%</td>
<td>1.3%</td>
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<tr>
<td>Death</td>
<td>0%</td>
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Results of the carotid stents in high-risk patients have surpassed expectations. Few complications are present in follow up exams and, in the vast majority of patients, there has been no recurrence of stenosis.
Gene Therapy -- Therapeutic Angiogenesis Trials

Gene therapy approaches are being used to treat patients with various forms of lower extremity peripheral vascular disease. While this form of therapy is in early stages of development, it will likely play an important role in the treatment of patients with peripheral vascular disease in the future. Ongoing trials are listed below:

**HGF-STAT Trial:**
Therapeutic angiogenesis trial for no-option patients with critical limb ischemia such as ulcers or rest pain.

**Del-1 Trial:**
Therapeutic angiogenesis trial for patients with disabling claudication (leg pain with ambulation).

**HIF-1α Trial:**
Therapeutic angiogenesis trial for patients with disabling claudication (leg pain with ambulation).

We are presently the primary investigating center in a trial testing whether an angiogenic growth factor injected in the which can reduce limb loss or claudication in patients with PVOD.

**TRANSFORMING MEDICINE**

The Basic Research Laboratory in the Section of Vascular Surgery is actively involved in defining the molecular pathways that are involved in regulation of smooth muscle cell phenotype. This research will be important in preventing common vascular processes such as atherosclerosis and prevent bypass surgery and stent failure. Members of the research laboratory have also discovered novel proteins that can inhibit or stimulate the growth of new blood vessels. This discovery has led to research that will have a role in both cancer therapy as well as the treatment of patients with ischemic heart disease and peripheral vascular disease. The laboratory is supported through NIH- and AHA-sponsored grants. Members of the laboratory train both undergraduate and graduate students as well as post-doctoral fellows.
Peripheral Vascular Occlusive Disease

Patients experiencing discomfort, cramps, or pain in the hip, thigh or calf when walking, or increasing pain in the feet while at rest, may need to be evaluated for lower extremity arterial disease. Diagnosis includes noninvasive testing using Doppler ultrasound, duplex scanning and magnetic resonance angiography. In most cases, lower extremity disease can be managed with risk factor modification and exercise. In severe cases and when risk management is not effective, surgical or interventional treatment is considered.

To determine the best modality, we review the amount of arterial blockage, the overall health status of the patient and the patient’s adherence to risk factor modification.

Exciting innovations such as the development of less invasive combined opened surgical and endovascular procedures, an angiogenesis clinical trial for peripheral vascular disease, and the drug treatment of vein grafts to prevent re-stenosis, are all being pioneered at Dartmouth-Hitchcock Medical Center.

Complex limb salvage is one of our primary clinical and research areas with a particular focus on the treatment of advanced diabetic foot problems.

Before and after images of an occluded right common and external iliac artery which is opened with a stent graft. DHMC has one of the best reported experience in the United States using stents for PVD.
Renal and Mesentenic Vascular Disease

Prompt treatment of renovascular occlusive disease may dramatically improve blood pressure control and even improve renal function if detected before major kidney damage has occurred. Advances in imaging enable the detection of renal artery stenosis using noninvasive techniques such as duplex ultrasound. Once detected, treatment options for the majority of patients include percutaneous renal angioplasty and stent placement.

The Section of Vascular Surgery has reported excellent experience with this technique, including the use of low profile catheter and guidewire systems, and renal protection devices, to minimize the chance of kidney injury during a procedure. For those patients who are not successful with stent placement, open surgery, endarterectomy or bypass, is required.

Dartmouth-Hitchcock Medical Center results using renal artery stents for the treatment of hypertension and declining renal function in graphic, chart and radiologic formats.

Vascular Surgery at DHMC has also recently reported the use of endovascular stents for the treatment of chronic mesenteric ischemia. This new application of technology offers the opportunity to improve the health of a critically ill group of patients so that they may be a better fit for bypass surgery which will provide a more durable long-term result.
Venous Disease

Venous disease affects a significant portion of the population and can take many forms, ranging from cosmetically unpleasing spider telangectasias to painful varicose veins or serious venous ulcerations. The Section of Vascular Surgery uses the latest advances in technology to treat the complete range of venous disease. We are currently employing a minimally-invasive approach using laser technology to treat varicose veins, an alternative to the traditional surgical approach of vein stripping. While providing less pain and quicker recovery, this technique is not appropriate for every patient. Thus, each patient with venous disease is carefully evaluated in the Vascular Laboratory to determine whether conservative, surgical or interventional treatment is appropriate.
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