Wake Radiology excels with minimally invasive procedures

Interventional radiologists lead the Triangle

Wake Radiology Interventional Services offers patients a number of benefits, including combined experience that spans nearly a century and close continuity of care, since the physician who sees the patient typically also performs the procedure. Patients benefit from the convenience and individual attention afforded by an outpatient setting at Wake Radiology’s Cary IR office.

Carroll Overton, M.D., director of interventional radiology services, leads a group of eight fellowship-trained interventional radiologists. “Whether it is by transvenous, transarterial, or other minimally invasive means, we offer patients alternatives to many surgical procedures,” Dr. Overton says. Advances in image quality and speed of acquisition provide remarkable anatomic detail, and innovative equipment allows high precision while sparing healthy tissue. “We work with microcatheters — they are no bigger than what you’d see coming off a fishing reel,” he says.

Healthy looking legs may hide valvular dysfunction

It is estimated that by age 60, approximately 50 percent of women and 25 to 30 percent of men will have chronic venous insufficiency (CVI). Wake Radiology’s Susan Weeks, M.D., a vascular and interventional radiologist, has for over 5 years been treating vein patients with CVI who suffer from a variety of symptoms that include aching, pain, heaviness, throbbing, tingling, itching, or burning.

CVI usually affects two main superficial veins including the great saphenous vein (GSV) and the small saphenous vein (SSV). When associated tributaries become affected, varicosities may develop. In addition to varicosities, other visible signs include edema and lipodermatosclerosis (skin color changes). It is important to note, however, that some patients may have no visible signs of CVI and still have valvular dysfunction. “It is important to have CVI in your differential, even if the person’s legs look perfectly healthy,” Dr. Weeks advises referring physicians.

In addition to the more common superficial CVI, valvular dysfunction can also affect the lower extremity deep venous system, oftentimes secondary to prior deep vein thrombosis (DVT). Doppler ultrasound is frequently used to identify the exact problem. This painless examination uses a cuff (similar to a blood pressure cuff) applied to the calf just above the ankle. “We evaluate the deep and the superficial venous systems, including associated perforator and communicating veins. We look not only for appropriate valve closure, but also for the presence of venous thrombosis, both chronic and acute.”
When venous insufficiency affects either the GSV or SSV, catheter directed thermal heat ablation, including laser or radiofrequency, offers a highly effective nonsurgical treatment. “Endovenous laser ablation (EVLA) is a one-hour procedure performed in our office with local anesthesia and an oral relaxant such as Xanax,” Dr. Weeks explains. Using ultrasound for guidance, a laser fiber is advanced up the vein to be treated, the surrounding soft tissues are anesthetized with dilute local anesthetic, and the dysfunctional vein is ablated with a gentle pullback of the catheter, allowing a constant deposition of energy along the length of the vein. This results in inflammation and fibrosis of the treated vein, with eventual resorption by the body.

“The EVLA procedure is 95-98 percent effective and does not carry with it the associated morbidity seen in conjunction with surgical stripping procedures,” Dr. Weeks says. “Patients walk out of the room when they are done, and the next day they are back to normal activities as tolerated, except no heavy exercise and no long travel for two weeks. The most onerous part for many patients is that we have them wear their compression stockings for two weeks following the procedure.”

While EVLA effectively ablates long, non-tortuous superficial veins, protruding varicosities can be treated percutaneously as well. After dilute anesthetic is administered, tortuous varicose veins are sequentially removed via tiny (two millimeter) incisions created along the length of the vein. A hook instrument is used to gently extract the vein, segment by segment. This is known as an ambulatory phlebectomy, and is often performed in conjunction with EVLA.

While symptoms resolve for most patients following EVLA with or without phlebectomy, some patients may have persistent symptoms that can be due to untreated venous insufficiency involving the GSV below the knee. Currently, heat ablation is not commonly used in conjunction with below-knee GSV reflux because the saphenous nerve runs in close proximity to the vein, raising the possibility of significant nerve injury, Dr. Weeks cautions. Instead, catheter directed sclerotherapy has proven more useful for ablating this segment of the GSV. This is accomplished via the straightforward placement of a small-bore, end-hole catheter into the below-knee GSV under ultrasound guidance. A sclerosant is then gently injected through the catheter as it is slowly withdrawn, resulting in irritation, inflammation, fibrosis, and resorption of the vein.

Treatment timeframe is another consideration. Patients with more acute medical problems such as ulceration, hemorrhage, or recurrent thrombophlebitis can be treated immediately. But for patients whose painful legs are interfering with activities of daily living, most insurers require a trial of conservative therapy: the use of 20mm to 30mm compression stockings, elevation, over-the-counter pain medications, and attempted avoidance of activities that exacerbate symptoms. For some, the compression stockings work well, Dr. Weeks says. For others, symptoms recur when they take off the stockings, and with insurance company approval, they proceed to treatment.

While many patients with CVI are significantly symptomatic, others may be more concerned solely with the appearance of their legs. In the latter patient population, sclerotherapy and microphlebectomy are also useful. Both procedures have their advantages and disadvantages. Dr. Weeks notes, “Phlebectomy is an excellent minimally invasive procedure, well tolerated by patients, and it results in the absolute removal of the vein 99+ percent of the time. However, when compared with sclerotherapy, it is a bit more invasive, requires tiny incisions, and the procedure is a bit longer than sclerotherapy. Sclerotherapy involves straightforward injections with a tiny 30-gauge needle into the vein. No prepping is required, there are no incisions, and it is usually a 30-minute procedure. The disadvantage of sclerotherapy is that it may require more than one treatment to make the vein completely resolve, whether it is a spider vein or a 5-millimeter varicosity. It is multi-factorial whether or not a single sclerotherapy session will be successful, and unfortunately, we still do not understand all of the variables involved.”

An important point to remember is that CVI is a lifelong diagnosis. With the current technologies, CVI is not cured, and valves that were once functioning normally can become incompetent, which may or may not result in significant symptomatology. Dr. Weeks emphasizes to her patients that once they have chronic venous insufficiency, they will always have it. “We tell our patients to keep an eye on their legs for any changes in appearance as well as changes in symptomatology, and we recommend they continue to wear at least mild compression as frequently as they can in order to maintain good leg health.”

**Venous obstruction in the pelvis may cause leg symptoms**

Besides valvular dysfunction, another cause of leg symptoms is venous outflow obstruction in the pelvis. “This can be seen especially in patients who have had a history of deep vein thrombosis,” Dr. Weeks notes. CT or MRI is used for diagnosis, with a preference for MRI because it does not use radiation. One of the more common findings is May-Thurner Syndrome, in which the right common iliac artery is compressing the left common iliac vein. Extrinsic venous compression can result in scarring of the vein, with or without associated thrombosis. If thrombosis is present, catheter-directed thrombolysis may be indicated. Once the vein is recanalized, a stent is usually required.
to maintain patency. Stent placement is performed under fluoroscopic guidance, using catheter venography as a roadmap. “You always have to keep in the corner of your mind that venous obstruction in the pelvis is another possible cause of leg symptoms,” she says.

**Minimally invasive UFE offers alternative to hysterectomy**

Of the 600,000 hysterectomies performed each year, perhaps half are due to leiomyomatous disease. As the nation strives to reduce this number, Wake Radiology’s interventional radiologists team with gynecologists to offer patients a nonsurgical option: uterine fibroid embolization (UFE). The procedure is performed in a hospital and includes an overnight stay for pain management. Approximately 90 percent of women receive relief from symptoms, and the complication rate is a low 0.2 percent.

Candidates are women with uterine leiomyomata who no longer desire fertility. For their diagnostic imaging, Dr. Overton explains, “If they have a high-quality ultrasound that gives us the answer, that is good enough. If they do not have prior imaging, or if the ultrasound shows something that is unclear, we will proceed to MRI for diagnostic imaging prior to treatment.”

“This is a transarterial procedure, very much like heart catheterization, with the same access in the top of a leg as a heart catheter, but we stop in the pelvis,” he explains. “This can be challenging, but the success rate of completing the procedure is about 98 percent in the United States.” Follow-up does not involve additional imaging unless there is a concern, he adds, and the recurrence rate is less than 10 percent.

**Nonsurgical embolization relieves women’s pelvic pain**

Another minimally invasive procedure that benefits women is embolization to treat pelvic congestion syndrome, also referred to as pelvic venous insufficiency. This painful condition, which can last for years and affect every element of a woman’s life, is caused by reflux of blood in the ovarian vein. The malady primarily affects women during their childbearing years. “This is a source of discomfort that is very much under-diagnosed,” explains vascular and interventional radiologist Michael Kwong, M.D. “But it is a very well-known, well-documented entity, and we have a nonsurgical treatment for it.” For this image-guided outpatient procedure, a tiny nick is made at the groin, a small catheter is inserted, and the ovarian vein is permanently occluded using coils and either a sclerosant or an embolic agent. This forces venous blood return to seek normal collateral veins that have competent valves, thereby resolving the problem.

**Varicocele embolization can improve infertility in men**

Similar to pelvic congestion syndrome, reflux in the testicular veins can produce varicoceles in men. Nonsurgical embolization can also be used to treat men suffering from varicoceles, abnormally enlarged veins in the scrotum that can cause pain, testicular atrophy, or infertility. Varicocele embolization is also an outpatient procedure performed under mild IV sedation and local anesthetic, and it takes approximately two hours.

**Thyroid nodule biopsies help diagnose cancer**

In the diagnostic arena, image-guided biopsies increasingly provide definitive answers without the pain, long recovery, and expense of surgery. This is the case for thyroid nodules that frequently are incidental findings on chest CT, cervical spine MR, or carotid ultrasounds. One in ten thyroid nodules is cancerous, and physicians need to know how concerned they should be.

“The imaging evaluation begins with a high-resolution ultrasound to assess the physical nature of the nodule,” Dr. Kwong explains. “If a nodule is confirmed to be solid and has indeterminate characteristics, then a nuclear medicine scan may be performed to assess the physiological nature of the lesion.”

How large should a nodule be before it is appropriate to biopsy it? That’s a frequent and important question, Dr. Kwong acknowledges. “The consensus statement from the Society of Radiologists in Ultrasound provides size criteria and scientific, data-driven recommendations on that.” (See chart.)

The biopsy is performed in Wake Radiology’s Cary IR office, where the interventional suite provides a sterile operative setting. A repeat high-resolution ultrasound is performed to confirm the diagnostic findings prior to the procedure. “If I see there are tiny calcifications or an area that is more vascular, I specifically target the most suspicious
Less invasive techniques aid oncology patients

Wake Radiology Interventional Services has a well-established record of helping cancer patients. "Our skills in doing image-guided procedures match up well with oncology," says Philip Pretter, M.D., a vascular and interventional radiologist. "Referring physicians realize there is a lot of value in less-invasive techniques, and the ability to do some procedures as an outpatient is quite beneficial to the patient."

One strength is image guidance for nonsurgical biopsies. "If the tumor is very small, you may only see it with a CT scan, an ultrasound, or an MRI. Being able to direct a needle under the guidance of that machine taking pictures allows you to precisely target that lesion."

"This is something we can do with an 18- or a 20-gauge needle that requires no stitches, just a tiny nick in the skin, local anesthesia, and a little bit of conscious sedation," he says.

Interventional techniques play a role in treatment as well. Radiofrequency ablation treats liver or kidney tumors and has even been used on lung tumors, Dr. Pretter notes. For palliative care, interventional radiologists can treat metastatic liver disease with radioactive microspheres or with chemoembolization, which directly deposits a high concentration of chemotherapy to the target location.

Society of Radiologists in Ultrasound
Recommendations for Thyroid Nodules 1cm or Larger in Maximum Diameter

<table>
<thead>
<tr>
<th>ULTRASOUND FEATURE</th>
<th>RECOMMENDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solitary nodule – microcalcifications</td>
<td>Strongly consider ultrasound-guided FNA if &gt; 1 cm</td>
</tr>
<tr>
<td>Solid (or almost entirely solid) or coarse calcifications</td>
<td>Strongly consider ultrasound-guided FNA if 1.5 cm</td>
</tr>
<tr>
<td>Mixed solid and cystic or almost entirely cystic with solid mural component</td>
<td>Consider ultrasound-guided FNA if &gt; 2 cm</td>
</tr>
<tr>
<td>None of the above, but substantial growth since prior ultrasound examination</td>
<td>Consider ultrasound-guided FNA</td>
</tr>
<tr>
<td>Almost entirely cystic and none of the above and no substantial growth (or no prior ultrasound)</td>
<td>Ultrasound-guided FNA probably unnecessary</td>
</tr>
<tr>
<td>Multiple nodules</td>
<td>Consider ultrasound-guided FNA of one or more nodules, with selection prioritized on basis of the criteria (in order listed) for a solitary nodule*</td>
</tr>
</tbody>
</table>

*The panel had two opinions regarding selection of nodules for FNA. The majority opinion is stated here.

Outpatient port placement at Wake Radiology saves time, reduces stress

To help ease the pain and stress of cancer treatment, Interventional Services offers outpatient placement of ports and catheters. Some allow access to veins for lab work, medications, or chemotherapy, and the newer power-injectable ports can accommodate the injection of contrast for follow-up CT scans. Port placement, which takes about an hour or slightly less, is performed in the Cary IR office. "We use ultrasound and fluoroscopic guidance to place ports accurately, so that they function well for long periods of time," says Dr. Pretter. "Many outpatients come in, have the port placed, and oftentimes start chemotherapy the same day."

Techniques help relieve complications of cancer

A number of interventional procedures help oncology patients with complications such as ascites or pleural effusions. "We are often asked to do a paracentesis to remove the fluid from the abdomen or a thoracentesis to remove excess pleural fluid from around the lungs. These procedures can be both diagnostic and therapeutic as the fluid can be sent for laboratory analysis. Higher volume
The skilled hands of experienced interventional radiologists provide vital help in relieving the severe pain of vertebral compression fractures. These fractures are most frequently caused by osteoporosis, a widespread and costly disease. “There are 10 million Americans with osteoporosis and another 34 million at risk of developing the disease,” notes Pete Leuchtmann, M.D., a joint and spine interventional specialist who is fellowship trained in both interventional and musculoskeletal radiology. “The annual cost for fractures due to osteoporosis is on the order of $20 billion. In the United States, there are an estimated 700,000 vertebral compression fractures each year.”

For the appropriate patient population, Dr. Leuchtmann says, minimally invasive vertebral augmentation procedures—vertebroplasty or kyphoplasty—are the most effective therapy. “Some 75 to 90 percent of patients show significant relief, typically within the first days after the procedure.”

Vertebroplasty involves a fluoroscopically guided injection of bone cement into the fractured vertebra. Kyphoplasty utilizes a balloon to create a void and correct the deformity, restoring some height to the fractured vertebra. A similar procedure, sacroplasty, is used to treat sacral fractures.

“The patients for whom this treatment is most appropriate are usually in their fifties or older, have osteoporosis, and have developed a fracture from weakened bones,” Dr. Leuchtmann explains. Indications for treatment include acute or subacute onset of back pain, most often with point tenderness, and pain that interferes with normal daily activities without medication. Wake Radiology interventionalists also treat vertebral fractures in cancer patients, typically those with advanced-stage cancer or cancer with bone metastases.

“Imaging studies to demonstrate compression fracture should always begin with radiographs,” Dr. Leuchtmann says. Most patients undergo an MRI during their workup to determine the acuity of the compression fracture. For patients who cannot undergo an MRI, a bone scan and CT scan combination can be performed. These findings are crucial in determining which patients will most likely benefit. “Optimal results are obtained in patients with active bone edema on MRI, usually within two to six weeks of their fracture,” he says.

Numerous factors affect the interventional radiologist’s choice of vertebroplasty or kyphoplasty, among them the fracture location. “We are not able to treat fractures in the highest portion of the thoracic spine because of the smaller size of the vertebra at those levels. Typically, the highest level we treat with Balloon Kyphoplasty is T7. We may go up to the T5 level with vertebroplasty.”

Vertebroplasty is performed as an outpatient procedure at WakeMed in Raleigh. It requires only conscious sedation and local anesthesia, and it takes about 40 minutes. Using c-arm fluoroscopy as a guide, the interventional radiologist inserts a needle/cannula into the fractured vertebral body and infuses it with surgical bone cement, polymethyl methacrylate. The cement hardens within 15 minutes, stabilizing the fracture and preventing further collapse.
The overwhelming majority of patients report no pain from the procedure itself. If necessary, more than one vertebral level can be performed in a single setting. Post-procedural fluoroscopic images are obtained for documentation. After a vertebroplasty, patients remain in bed for two hours.

Patients often report improvement immediately, and most report pain relief or significant improvement over the next 48 hours. Vertebroplasty has a typical success rate of greater than 80 percent for patients with osteoporosis and greater than 50 to 60 percent for treatment of neoplastic fractures.

Vertebroplasty has been shown to be safe when performed in the appropriate setting by a well-trained physician. The incidence of complications is less than 1 percent in osteoporotic patients and less than 5 percent in the neoplastic population.

Balloon Kyphoplasty, a slightly more invasive procedure, is also performed at WakeMed in Raleigh. This procedure, like vertebroplasty, is usually performed on an outpatient basis, although there are times when inpatients need the procedure as well. With kyphoplasty, a balloon introduced into the center of the vertebral body is used to create a cavity in the bone and to increase the height of the fractured vertebra. The space is then filled with bone cement. Pain relief can be dramatic and nearly complete in more than 80 percent of patients.

“Overall, vertebral augmentation procedures have provided dramatic relief for count- less patients with debilitating pain,” Dr. Leuchtmann says. “No longer suffering from the fractures, these individuals can avoid the side effects (deconditioning, pulmonary complications, etc.) of being bedridden or on narcotic pain medications, and they can return to their normal activities and enjoy their lives.”

**Saving the lives of trauma patients**

Quite often a Wake Radiology interventional radiologist gets a call and heads for WakeMed’s emergency department, one of the busiest in the state. Thomas Presson, M.D., a vascular and interventional radiologist, describes the typical situation. “Acute hemorrhage in a trauma patient is a typical emergency case. Bleeding may be caused by penetrating trauma or blunt trauma, such as a car accident. Bleeding from small vessels, or vessels within organs such as the liver or spleen, may be particularly hard to approach surgically due to the risk of further disturbing the damaged organ. In that case, we do an embolization where you run a little catheter right up into the bleeding vessel and block it off.”

“If a trauma patient is particularly unstable, our objective is to immediately find the bleeding vessel and stop the bleeding. Sometimes you embolize the bleed site without even seeing exactly which vessel is disrupted, because you have to do something before it’s too late. “Those are particularly gratifying because the injuries are life-threatening. A surgical approach is felt to be dangerous by the surgeons, and that’s why they’ve asked us to look at them. In some cases, it’s one of the few alternatives a patient may have,” Dr. Presson says.

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  - Microphlebectomy
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  - Laser Ablation of Superficial Venous System
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CARROLL C. OVERTON, MD
Vascular & Interventional Radiologist
Director of Interventional Services
- Medical School | University of North Carolina School of Medicine, Chapel Hill
- Residencies | Diagnostic Radiology, Mercy Hospital of Pittsburgh, Diagnostic Radiology, University of Pittsburgh Medical Center, Surgical Residency, Mercy Hospital of Pittsburgh
- Fellowship | Interventional Radiology, Alexandria Hospital, Alexandria, VA
- Certification | American Board of Radiology – Diagnostic Radiology
- Appointments | Director of Interventional Services, Wake Radiology, Chairman, Credentials Committee, WakeMed (2010)
- Membership | Society of Interventional Radiology, North Carolina Medical Society, Wake County Medical Society
- Joined practice in 1998

ALAN B. FEIN, MD
Vascular & Interventional Radiologist
- Medical School | Columbia University College of Physicians and Surgeons, New York
- Residencies | Internal Medicine, Emory University Affiliated Hospitals, Atlanta; Diagnostic Radiology, Duke University Medical Center, Durham
- Fellowships | Min-fellowship Vascular Interventional Radiology, Duke University Medical Center, Vascular IR and Abdominal Imaging, Mallinckrodt Institute of Radiology, Washington University School of Medicine, St. Louis, MD
- Certifications | American Board of Radiology – Diagnostic Radiology, American Board of Internal Medicine, National Board of Medical Examiners
- Memberships | ACR, Society of Interventional Radiology, North Carolina Medical Society
- Joined practice in 1986

ANDREW WU, MD
Vascular & Interventional Radiologist
- Medical School | Washington University School of Medicine, St. Louis
- Residency | Diagnostic Radiology, Mallinckrodt Institute of Radiology, Washington University School of Medicine, St. Louis
- Fellowship | Interventional Radiology, University of Michigan Medical School, Ann Arbor
- Certification | American Board of Radiology – Diagnostic Radiology
- Appointments | President, NC state chapter of ACR (2010), Fellow of American College of Radiology (5/2011)
- Memberships | American College of Radiology, Society of Interventional Radiology, North Carolina Medical Society, Wake County Medical Society
- Joined practice in 1991

PHILIP C. PRETTER, MD
Vascular & Interventional Radiologist
- Medical School | University of Pittsburgh School of Medicine, Pittsburgh
- Residency | Diagnostic Radiology – Chief Resident, University of Pittsburgh Medical Center
- Fellowship | Interventional Radiology – Fellow of the Year, Department of Radiology, University of Pittsburgh School of Medicine
- Certification | American Board of Radiology – Diagnostic Radiology
- Appointments | Vice Chairman, Department of Radiology, WakeMed Raleigh Hospital
- Memberships | American Roentgen Ray Society, Radiological Society of North America, Society of Interventional Radiology, NC Medical Society, Wake County Medical Society
- Joined practice in 2000

THOMAS L. PRESSON JR., MD
Vascular & Interventional Radiologist
- Medical School | Bowman Gray School of Medicine of Wake Forest University, Winston-Salem
- Residency | Diagnostic Radiology, Duke University Medical Center, Durham
- Fellowship | Vascular and Interventional Radiology, Duke University Medical Center
- Certification | American Board of Radiology – Diagnostic Radiology
- Appointments | Radiation Safety Officer – Wake Radiology, WakeMed Raleigh, WakeMed Cary Hospital
- Memberships | American College of Radiology, Society of Interventional Radiology, North Carolina Medical Society, Wake County Medical Society
- Joined practice in 2001

MICHAEL D. KWONG, MD
Vascular & Interventional Radiologist
- Medical School | University of Texas School of Medicine, San Antonio
- Residency | Diagnostic Radiology, Boston Medical Center
- Fellowship | Vascular and Interventional Radiology, University of California San Diego Medical Center
- Certification | American Board of Radiology – Diagnostic Radiology
- Memberships | Society of Interventional Radiology, Radiological Society of North America, American College of Radiology, North Carolina Medical Society, Wake County Medical Society
- Joined practice in 2003

PETER L. LEUCHTMANN, MD
Vascular & Interventional Radiologist
Musculoskeletal Radiologist
- Medical School | Indiana University School of Medicine, Indianapolis
- Residency | Diagnostic Radiology, University of Maryland School of Medicine, Baltimore
- Fellowships | Cardiovascular/Interventional Radiology, The Johns Hopkins Hospital, Baltimore; Musculoskeletal Radiology, University of North Carolina Hospitals, Chapel Hill, NC
- Certifications | American Board of Radiology – Diagnostic Radiology, International Society for Clinical Densitometry
- Memberships | American College of Radiology, American Roentgen Ray Society, Radiological Society of North America, Society of Interventional Radiology, International Spine Intervention Society, North Carolina Medical Society, Wake County Medical Society
- Joined practice in 2006

SUSAN M. WEEKS, MD
Vascular & Interventional Radiologist
- Medical School | University of North Carolina School of Medicine, Chapel Hill
- Residency | Diagnostic Radiology, University of North Carolina Hospitals, Chapel Hill
- Fellowship | Vascular and Interventional Radiology, University of North Carolina Hospitals, Chapel Hill
- Certification | American Board of Radiology – Diagnostic Radiology
- Memberships | American College of Radiology, American Roentgen Ray Society, Radiological Society of North America, Society of Interventional Radiology, North Carolina Medical Society, Wake County Medical Society
- Joined practice in 2006

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