The year 2003 marks the 10 year anniversary of the Division of Vascular Surgery at Stanford. Our primary mission has been to provide the best possible care to patients with vascular disease, to educate of future leaders of vascular surgery and to probe the frontiers of new knowledge with basic and clinical research. We can be proud of our accomplishments in all three areas. In this issue of the newsletter we pay special tribute to our Vascular Surgery Fellows and to our training program.

Our vascular surgery training program was established in 1993 as a two year program with the first year devoted to clinical vascular surgery and the second year devoted to research. During the first year, each of our fellows have become clinically expert, performing 350-400 vascular reconstructions and exceeding the requirements of the American Board of Surgery by a large margin. During the second year, our fellows have performed leading edge research, presented and published their findings and most have been recruited to faculty positions at top academic medical centers around the country. Beginning In 1996, our second year fellows have been actively involved in groundbreaking clinical trials of endovascular AAA repair being conducted in our Division and have gained endovascular catheter based skills which have not previously been part of vascular surgery training. The clinical success of endovascular AAA repair has revolutionized the practice of vascular surgery and brought new training requirements to our specialty. The ACGME Residency Review Committee now requires the teaching of endovascular skills and it has become clear that one year of clinical training is no longer sufficient to gain all the knowledge and experience needed for vascular surgeons of the future. Therefore, in order to fulfill the current training requirements, we have decided to restructure our fellowship training program from a one year to a formal two year accredited program. The first year will continue to be largely devoted to open vascular surgery with the second year devoted to endovascular surgery, non-invasive vascular diagnosis and clinical research. Our vascular surgery training program will be reviewed by the ACGME with a site visit on February 6, 2003 at which time our proposal for accreditation of the two year program will be reviewed. We are proud of our vascular fellows and look forward to their accomplishments in the years to come.

-- Christopher K. Zarins, MD

### Highlights:

- **Featured story:** Custom MRI cycle tracks blood flow during exercise (this page)
- Previous and current fellows (Page 2)
- Interesting case and answers (Page 3)
- Bulletin board (Page 4)
- Upcoming events (Page 4)

### Featured Story: Custom MRI cycle tracks blood flow during exercise

For most people, an MRI scan requires lying completely motionless while they are transported inside the narrow bore of the giant MRI magnet. At the medical center, however, a years-long collaboration among faculty in radiology, vascular surgery and mechanical engineering has made possible a completely different MRI experience in which the patient sits upright and pedals a custom-built exercise cycle inside the machine.

The cycle, believed to be the first of its kind, enables School of Medicine researchers to precisely and non-invasively measure patients’ blood flow while they exercise. That information yields a better understanding of vascular disease, which could ultimately lead to improved diagnosis and treatment.

"If you want to understand patients’ blood flow, you need to see them in various physiological states," explained Charles Taylor, PhD, assistant professor of surgery and mechanical engineering, who spearheaded the project along with radiology professor Robert Herfkens, MD.

*Adapted from: Stanford Report, January 22, 2003*
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New Fellow to be Selected for 03-05

Please recommend news, articles, and offer suggestions. Volunteer editors wanted. Thank you.
Case history appeared on last month newsletter, December 2002: An elderly woman complains of a rapidly expanding pulsatile mass in the right neck for the past few weeks. A small mass, however, has been present for several years. The patient had a carotid endarterectomy 15 years ago (Figures X and Y). What is the diagnosis? What would you do? --- Provided by Dr. Eugene Lee

Management and outcome of the case -- by Dr. Eugene Lee

This patient was admitted to the intensive care unit with careful blood pressure control and the placement of several lines: arterial line, central line, and several large bore IV’s. Then via a right groin puncture, the right carotid artery was catheterized and a 8.5 mm balloon was placed just proximal to the pseudoaneurysm. This was done to have proximal control of the carotid artery prior to operative repair. As dissection proceeded close to the carotid artery, the balloon was inflated to occlude the inflow. There was brisk back bleeding from the internal and external carotid arteries which was controlled by placement of vessels. An intraoperative shunt was placed as shown in Figure 1. The internal carotid artery and common carotid artery was primarily anastomosed with the external carotid artery ligated. The patient awoke with no new neurologic sequelae and was subsequently discharged. A post-operative picture is shown in Figure 2.

Figure X. A lateral view of the pulsatile mass. Note the ulceration and blood staining on the shirt.

Figure Y. An AP view of the same mass

Figure 1. The rammels are placed around the internal and common carotid artery with the vesselloop around the external carotid artery. Note the intraoperative shunt.

Figure 2. A post-operative photo of the carotid pseudoaneurysm repair.

Please offer your interesting case for the future issues. Thank you.
Upcoming Events

- Dr. Seymour Glagov – Professor emeritus of the University of Chicago will be visiting February 19-23, 2003
- Mini Symposium of hemodynamics and vascular remodeling in honor of Dr. Seymour Glagov, held by Division of Vascular Surgery, 8:30 – 11:30 am, Thursday 20, 2003, Monzer Auditorium, Beckmen Center, Stanford University. [see the poster]
- Mini Symposium in honor of Dr. Norman Rich, who will deliver the Holman Lecture on March 7, 2003
- Stanford / UCSF Symposium – May 1-3, 2003, at the Renaissance Stanford Court
- SVT Symposium, May 4, 2003 just following the Stanford / UCSF symposium

Publications:

- Filis KA, Arko FR, Rubin GD, Raman B, Fogarty TJ, Zarins CK. Aortoiliac angulation and the need for secondary procedures to secure stent graft fixation: which angle is important? Int Angiol. 2002 Dec;21(4):349-54. [abs, pdf]

Please send your new publication and presentation for future bulletinboard, thank you.

MRI

(Continued from page 1)

"Until now, we could accurately measure blood flow only when the patient was at rest, and with vascular disease, that’s not enough." With some vascular disorders, symptoms become apparent only during physical activity.

MRI technology has long been used to measure blood flow at rest, but obtaining such data on an exercising patient wasn’t feasible for various reasons: The standard-model MRI’s enclosed design made exercise there virtually impossible. No metal is permitted inside the magnet. And to ensure accurate readings, patients must remain still.

Researchers at other institutions tried various methods to measure blood flow during exercise, but these carried drawbacks. One method involved inserting a catheter inside the femoral artery, but this approach was invasive and could temporarily alter the artery’s function. Another strategy was to do an MRI scan on the patient immediately following exercise, but this yielded inaccurate results.

When Stanford acquired a high-powered, vertically open MRI in 1997, Taylor and Herfkens saw an opportunity to custom-design an exercise cycle for it. They assigned the project to a Stanford engineering class, which built a rudimentary prototype mostly of wood. Following a second iteration, Chris Cheng, then a doctoral student in mechanical engineering, took on the project in winter 2000 as part of his thesis. Cheng supervised a group of engineers at the Palo Alto Veterans Affairs Research & Development Center to design and construct a more durable, streamlined model. The final product, weighing about 80 pounds, consists of beech wood and high-density plastic.

The cycle, which slides into rails at the bottom of the MRI, is essentially a set of pedals that provide resistance around a large wheel. The seat is mounted inside the magnet. The patient’s torso is kept still by strapping him to the seat, and a coil that detects blood flow in the thoracic and abdominal aorta is wrapped around his torso.

As the patient pedals the cycle, the blood-flow data gathered by the magnet is transmitted to a high-powered computer. To an untrained observer, the pulsing black-and-white images displayed onscreen don’t look like much. But when the images are interpreted by specialized software Cheng developed, they indicate the rate at which blood is flowing through the artery and the amount of force exerted.

Stanford researchers are using the cycle in basic research on healthy adults and patients with intermittent claudication, a condition in which blood flow to the legs is obstructed, causing stiffness and pain. The data from the healthy patients is helping researchers understand normal blood flow under various conditions. Data from the second group is shedding light on a common vascular disorder, which could lead to better diagnosis and treatments.

"This bike is a tool that lets us squeeze more information from this already-useful [MRI] machine," said Ronald Dalman, MD, associate professor of vascular surgery at the Veterans Affairs Palo Alto Health Care System, who is using the cycle to monitor some of his patients. "In just a few minutes, you can get an incredible amount of useful data, which opens new possibilities for understanding vascular disease."

In collaboration with Jeffrey Feinstein, MD, assistant professor of pediatrics, Stanford researchers will soon use the cycle to monitor blood flow in children treated for congenital cardiovascular disease.

Herfkens said multidisciplinary collaboration has been key to the project’s success. "Making it work requires fantastic imaging equipment, engineers to develop the right hardware and software, technicians to run the equipment, and clinicians who want to use the data."

Adapted from: Stanford Report, January 22, 2003 by SARA SELIS