Mary Draney showed at the NIH AAA Pathogenesis Grantees’ Meeting that circumferential aortic wall motion is not uniform as is traditionally conceived. See details on page 5.

Message from the Chief

November is the month of Thanksgiving - a time to reflect and give thanks for our many blessings. We are indeed very fortunate to have the privilege of caring for patients with vascular disease, developing new therapies, discovering new knowledge, and educating the future generation of physicians who will treat vascular patients. We have a unique and special environment which integrates the highest quality patient care with groundbreaking clinical innovation and outstanding basic science research. But what makes this environment truly special is the wonderful community of kind, compassionate, dedicated and brilliant people who are working together to improve the well-being of patients with vascular disease. I would like to give a special thanks to each and every member of the vascular community for your important contributions this past year and to thank our colleagues and coworkers for their support and friendship. We have much to be thankful for - Happy Thanksgiving.

--- Christopher K. Zarins, MD

The newsletters are posted at:
Editorial manager: Chengpei Xu, cx11@stanford.edu

Current Students and Residents (photos shown above) on the Vascular Surgery Service:
- Debby Chao, MD, Intern, Graduated from UCLA, will be a urology resident at Stanford. Debby likes to cook and vouches for Martha Stewart (at least for her cooking). Next month - skiing
- Joyce Ho, visiting sub-intern, a 4th year medical student from UCSD. Joyce is applying for residency in general surgery with an interest in pursuing vascular surgery. She was born in Hong Kong and grew up in Oakland, CA.
- Sanjin Lee, a visiting 4th year medical student from NEOUCOM (Northeastern Ohio University College of Medicine). Sanjin was unable to do vascular surgery during his 3rd year rotation, so that is why he pursued this elective. He is presently interviewing for general surgery residency positions.
- Tom Nguyen, MD, GS categorical resident; college: Rice University, major: Economics & Asian studies; Med School: Johns Hopkins; Home town: Houston; Interests: hand held information technology, created a company while in medical school. He stated that he is the real "Tom Nguyen".
- Ramin Saketkhoo, 3rd year Medical student at Stanford University School of Medicine; Career interest: endovascular therapy; Undergrad: UC Berkeley (major: molecular biology); Outside interests: skiing, sports, traveling.
- Eugene S. Lee, MD, PhD, Vascular Fellow and head of the Vascular Surgical Service. Completed his general surgery train at the University of Minnesota. During his spare time on the service he plays golf.

Early morning rounds with the Vascular Surgery Service left to right: Sangjin Lee (medical student from Ohio); Debby Chao, MD, (intern); Tom Nguyen, MD, (intern); Ramin Saketkhoo (medical student from Stanford); Joyce Ho (medical student from UCSD); Eugene S. Lee, MD, PhD (fellow)
Featured Story: Alison M. Kerr, RN

--- By Christine C. Liona, RN, MS

Alison Kerr, RN, BSN, CVN, Nurse Manager of the Vascular Surgery Clinic. Alison completed her nursing training in Vancouver, B.C., Canada and continued her nursing in Toronto in pediatric intensive care prior to her move to Stanford. She started her Stanford career as a staff nurse on the intermediate intensive care unit in 1991. Alison joined the Division of Vascular Surgery as the Clinical Nurse Coordinator in October of 1993 when the Division was initially formed. She has thus, from the very beginning, set the standard of kind, compassionate, quality care which is the hallmark of the Vascular Service. Alison is a Certified Vascular Nurse and has developed the policies and procedures regarding care of the vascular surgery patient for the outpatient and inpatient clinical environment, acted as resource for the resident staff, provided continuing education to staff nurses, and developed clinical pathways for the postoperative vascular patient. In August of 1998, Alison was given the responsibility of managing the Vascular Surgery Clinic. Currently, Alison manages a staff of seven clinic associates, four Registered Nurses and one Physician’s Assistant and has assumed additional responsibilities in hospital management. Her performance in this role has been exemplary. Alison has created an environment that provides a high standard of care in which the patients and their families know that they can entrust themselves to the entire staff. In 1999 the Vascular Clinic received the Malinda Mitchell clinic award for Service Quality, which is the highest level of recognition for the quality of care at Stanford. The Vascular Clinic continues to receive the highest patient satisfaction reviews on a regular basis and serves as the model for responsiveness and quality of care. Alison’s leadership and example continues to set the standard of care in providing exceptional patient care from initial patient contact through inpatient hospitalization to long-term outpatient follow-ups. We thank Alison for her great contribution to the care of the vascular patients at Stanford.

Notes from the Stanford Vascular Laboratory

--- by Bonnie L. Johnson, RVT RDMS FSVT

“Patients often ask “What do all those letters mean?”

RVT ARDMS RDMS SVU RDCS ICAVL

Vascular technology, also known as vascular ultrasound, is a specialized aspect of Sonography. The Stanford Vascular Laboratory performs diagnostic examinations using ultrasound and other non-invasive diagnostic tools to evaluate blood vessels and associated conditions involving vascular anatomy and hemodynamics. To learn more about the Vascular Ultrasound Profession, contact the Society for Vascular Ultrasound (SVU), formerly known as the Society of Vascular Technology (SVT). http://www.SVUnet.org An organization made up of vascular technologist’s/ Sonographer’s, physicians and other healthcare professionals interested in the Vascular Ultrasound Profession.

Vascular Sonographers sit for a board exam and hold the specialty credential of Registered Vascular Technologist (RVT) via the American Registry of Diagnostic Medical Sonographers (ARDMS) http://www.ARDMS.org Other specialties in the Sonography profession include the Registered Diagnostic Cardiac Sonographer (RDCS) and the Registered Diagnostic Medical Sonographer (RDMS). Like other healthcare professions, Sonographers are required to obtain on-going continuing medical education (CME) credits throughout their career to maintain their certification. In accredited laboratories that education must be specific to the specialty being practiced.

Laboratory Accreditation by the Intersocietal Commission for Accredited Vascular Laboratories (ICAVL) demonstrates a laboratory is in compliance with minimum standards established by leaders and peers in the vascular ultrasound profession. The quality is monitored and RVT’s and MD’s must meet specified criteria to work in the laboratory. A laboratory can be accredited to perform different types of vascular exams. For example, our laboratory is accredited to perform cerebrovascular, peripheral vascular, venous, and visceral (abdominal vasculature). To learn more contact http://www.ICAVL.org.

Robertaj Lindenfelser performing lower extremity evaluation
**New Appointments**

- **Dr. Sheila Coogan** was appointed to the Young Surgeons Committee of the American Association for Vascular Surgery in June of 2002.
- **Dr. Sheila Coogan** is also on the Program Committee for the Peripheral Vascular Surgery Society Winter 2003 meeting.

**Abstract Submission Deadlines**

- ASA Abstract deadline 12/2/2002
- E.J. Wylie Traveling Fellowship - Deadline 1/15/2003

**Upcoming Events**

- Nephrology Grand Rounds on December 10, 2002 by Dr. Sheila Coogan Topic--Strategies to optimize Outcomes in Dialysis Access
- Stanford Surgical Grand Rounds – Abdominal Aortic Aneurysm, 12/10/2002 by Dr. Christopher K. Zarins
- Department of Surgery Holiday Party – 12/13/2002 – Faculty Club
- Vascular Surgery Holiday Party – 12/14/2002 – at the home of Chris & Zinta Zarins, be sure to join in the caroling, all are welcome
- Stanford / UCSF Symposium – May 1-3, 2003, at the Renaissance Stanford Court
- SVT Symposium, May 4, 2003 just following the Stanford / UCSF symposium

**Grants Submitted:**

Christopher K. Zarins, MD, Charles A. Taylor, PhD: Aortic Structure and Cyclic Strain in Human AAA. NIH AAA pathogenesis grant renewal, submitted November 1, 2002.

**Publications:**


**Presentations:**

- **Frank Arko MD**: Morphologic Changes and Outcome Following Endovascular AAA Repair (EVAR) as a Function of Aneurysm Size. Presented at the Western Surgical Association 2002 Annual Scientific Session held in Vancouver, British Columbia, Canada on November 17-20, 2002.
- **Christopher K. Zarins**, MD: EVAR is a better way to fix all anatomically appropriate AAAs. *VEITH Symposium*, Bronx, New York, November 21-24, 2002.
- **Mary T. Draney**, PhD, Charles A. Taylor, PhD, Christopher K. Zarins, MD: Quantitation of Biomechanical Determinants of Human AAA. Presented at the NIH AAA Pathogenesis Grantees’ Meeting, Bethesda, Maryland, November 14-15, 2002.
Editorial on the recently reported SAPPHIRE Trial

-- By Sheila M. Coogan, M.D.

For those of us who perform carotid angioplasty and stenting on selected patients, the results of the SAPPHIRE trial are encouraging since recent newsmedia reports suggest that the risk of carotid stenting is significantly lower than that of endarterectomy. However, we need to take a closer look at the data.

This month, Dr. Jay Yadav of the Cleveland Clinic Foundation reported the 30-day results of the SAPPHIRE trial at the 75th Scientific Session of the American Heart Association. The SAPPHIRE trial randomized 307 high-risk patients with carotid stenosis to either carotid angioplasty and stenting (CAS) or carotid endarterectomy (CEA). Patients either had symptomatic carotid stenosis greater than or equal to 50% or asymptomatic stenosis greater than or equal to 80%.

The 30-day results of the trial showed that the stroke/death rate was lower in the CAS group (4.5%) than the carotid endarterectomy group (6.6%) but was not statistically significant.

In raw numbers, this means that eight patients in the surgery group and six patients in the angioplasty group died and one angioplasty patient died.

Based on the small difference in stroke and death rate between the CAS and CEA groups, over 2100 patients would have to be randomized to each arm of the study to demonstrate a statistical significance in outcomes between these two treatment arms.

The combined 30-day endpoint of death, stroke and MI did reach statistical significance with a combined endpoint of 12.5% with surgery compared to 5.8% with stenting. This is the number reported in the media. However, with such a small sample size, the combined endpoint reaches significance because patients who had a stroke and died are essentially counted twice. Thus, the conclusion that patients who had CAS did significantly better than patients who had CEA is flawed.

How do the results for CAS in the SAPPHIRE trial compare to the reported stroke and death rate for conventional endarterectomy (CEA)? At Stanford University the risk of stroke and death with carotid endarterectomy is much lower. Brad Hill, MD published the Stanford experience in the Journal of Vascular Surgery in 1999. He reported on 390 consecutive patients treated with carotid endarterectomy at Stanford, including high risk redo carotid operations, and found a very low stroke death rate of only 0.8%. Many other centers have reported considerably lower stroke death rates for endarterectomy than the 6.6% reported in the SAPPHIRE trial. The reasons for the high stroke/death rate in SAPPHIRE should be investigated.

How do the results for stenting in the SAPPHIRE trial compare to outcomes reported by other trials?

The WALLSTENT trial, the only other prospective randomized trial comparing CAS (without the adjunctive use of a cerebral protection device) to CEA was clinically stopped because of a 12.1% stroke rate in the CAS group and a 4.5% stroke rate at 30-d in the CEA group.

Why did the WALLSTENT trial yield such dramatically different results? Perhaps the adjunctive use of a cerebral protection device in the SAPPHIRE trial accounted for the difference between these two randomized trials.

But if this were true, why are the early results of CEA by Dr. Yadav without cerebral protection even better than his own results with cerebral protection. Dr. Yadav reported results for 107 consecutive patients treated with CEA prior to the development of cerebral protection devices (Circulation 1997 Jan 21; 95(2):303-305) with results listed in Table below.

<table>
<thead>
<tr>
<th>Clinical Events</th>
<th>n</th>
<th>% of Patients (n=107)</th>
<th>% of Carotids (n=126)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedural events</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor stroke</td>
<td>1</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Major stroke</td>
<td>1</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Q-wave MI</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Non-Q-wave MI</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Death</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Post procedure events (in-hospital and 30-day)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor stroke</td>
<td>1</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Major stroke</td>
<td>1</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Non-Q-wave MI</td>
<td>1</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Death</td>
<td>1</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Permanent pacemaker (3 days)</td>
<td></td>
<td>1 0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Combined end points at 30 days</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All strokes plus death</td>
<td>10</td>
<td>9.3</td>
<td>7.9</td>
</tr>
<tr>
<td>Major strokes plus death</td>
<td>3</td>
<td>2.8</td>
<td>2.4</td>
</tr>
<tr>
<td>Ipsilateral major stroke plus death</td>
<td>2</td>
<td>1.9</td>
<td>1.6</td>
</tr>
</tbody>
</table>

MI indicates myocardial infarction

The SAPPHIRE trial suggests that there may be clinical equipoise between CAS and CEA at 30-days. Additional endpoints such as death and stroke at 12 months and secondary endpoints such as restenosis at 6 months, 1,2,and 3 years are not available. Previous reports of CEA outcomes have described a high rate of recurrent stenosis in patients treated with CAS. These studies will be critical in deciding whether vascular surgeons should embrace angioplasty and stenting or continue to recommend endarterectomy as both a safe and durable procedure.

The CREST trial is an NIH-sponsored prospective randomized trial that will be conducted over the next five years comparing patients treated with CEA to those treated with CAS. Until a prospective randomized trial that is statistically powered to produce meaningful results has been completed, the results of a single experience are not justification for a broader endorsement of CAS over CEA–especially when considering the very dissimilar results of the Wallstent trial.

Thus, we must wait for further data before we know whether carotid stenting can achieve comparable results to carotid endarterectomy.
Mechanobiologic Determinants of Experimental AAA

Principal Investigator: Ronald L. Dalman, M.D. (Presenter)

We are investigating the mechanisms by which hemodynamic forces modify the initiation and progression of AAA disease. Our original specific aims were 1) define patterns of gene expression associated with aortic flow loading and AAA formation and 2) determine how AAA patterns changed in response to modified hemodynamics. These aims have been addressed in two manuscripts entitled: Flow mediates AAA progression, cellular composition and oxidative stress (pending submission 5/02) and Flow loading induces macrophage antioxidant gene expression in experimental aneurysms (submitted to ATVB 5/02).

Quantitation of Biomechanical Determinants of Human AAA

Principal Investigator: Christopher K. Zarins, M.D.
Co-principal Investigator: Charles A. Taylor, Ph.D.

Presented by Charley A. Taylor, PhD, Mary T. Draney, PhD, and Christopher K. Zarins from Stanford Vascular Surgery attended. The following are the abstracts of the presentation.

Quantitative Assessment of Aortic Strain: We have developed a new method to calculate vessel wall strain from cine PC-MRI velocity data. Forward-backward time integration is used to calculate displacement fields from the velocities, and cyclic Green-Lagrange strain is computed in segments defined by the displacements. The method was validated using a combination of in vitro cine PC-MRI and marker tracking studies. Phantom experiments demonstrated that wall displacements and strain could be calculated accurately from PC-MRI velocity data, with a mean displacement difference of 0.20±0.16mm (pixel size 0.39mm) and a mean strain difference of 0.01 (strain extent 0.20). A propagation of error analysis defined the relationship between the standard deviations in displacements and strain based on original segment length and strain magnitude. Based on the measured displacement standard deviation, strain standard deviations were calculated to be 0.015 (validation segment length) and 0.045 (typical segment length).

In vivo validation: We have validated this method in vivo, using a porcine thoracic aorta model. A custom-designed and built implantable MR coil was used to optimize signal from the vessel wall, and a variety of imaging parameters were tested ranging from the optimal in vitro conditions to the more challenging human environment. Validation was performed by comparing the calculated displacements to those of markers embedded in the media of the vessel wall. The mean difference between the displacement fields was ~0.1 mm, with pixel sizes ranging from 0.3mm – 0.9 mm. A propagation of error analysis demonstrated that a strain variation of 0.04 - 0.05 could be expected based on this level of displacement accuracy and peak strains of 0.2. Strain analysis of the descending thoracic porcine aorta indicates that the strain is non-uniform, however, further post-validation studies (imaging without embedded markers) will be necessary to prove (or disprove) this hypothesis. Histologic analysis of the porcine thoracic and abdominal aortas was performed on tissue from animals in the imaging studies. The imaging and histologic analysis of the porcine aorta has demonstrated a statistically significant correlation between wall thickness and wall motion, with the wall being thicker in regions of greater motion.

Human studies: We have applied this in vivo method in both normal human subject and patients with aneurysms. Calculation of cyclic strain in the thoracic aorta of a normal human subject related non-uniform deformation and circumferential variation in cyclic strain, as was found in the animal studies. Peak average strain in the human aorta was 0.08±0.11.

Computational models: We have made significant progress in the development of software for creating computer models of Human AAA from MR and Spiral CT data. Five discrete computational models have been constructed and 2 physical models. The physical models have been constructed using rapid prototyping methods for inclusion in experimental flow loops in experimental flow loops for validation of computational predictions.

Conclusion: The methods to quantify cyclic strain in experimental animals as well as in human aorta have now been validated. In vivo determination of cyclic aortic wall strain has proven to be very accurate based on our in vitro and in vivo testing. We are currently applying these methods to quantify aortic wall strain in controlled animal experimental settings to begin to address the question of relationship between cumulative wall strain and aortic wall degeneration.