David L. Dawson, MD

Dr. Dawson discusses the future of endovascular simulation, drug therapies for intermittent claudication, and his experience as Chief of the Medical Sciences Division at the NASA Johnson Space Center.

What improvements are still being made in medical simulation? How soon do you think the technology will be available for more disease and anatomical settings?

Simulation is just one of a number of education technology innovations that have fundamentally changed the way we teach and learn. Medical education has moved away from the traditional Halstedian model of apprenticeship that characterized residency training through most of the 20th century. There is more to learn and less time to learn it. Also, for endovascular specialists, there are needs for ongoing technical training throughout a decades-long career, maintenance of certification requirements, and decreased tolerance for error, waste, and inefficiency.

We are already seeing the next generation of endovascular procedure simulators, with more features (eg, thoracic endovascular aneurysm repair and infrainguinal interventions) and better fidelity (improved haptic interfaces and more nuanced representations of guidewire and catheter behaviors).

Patient-specific procedure rehearsal may be the next frontier in endovascular simulation. We already have sophisticated three-dimensional rendering capabilities that can use volumetric imaging data from computed tomography, rotational angiography, or other sources to model individual patient's anatomy. These representations of diseased vessels allow virtual deployment of stents or endografts, offering the interventionist a way to see how well specific devices may fit the patient. A future step is to incorporate patient-specific anatomy into endovascular simulators, allowing technical aspects of complex or unusual procedures to be rehearsed immediately before the actual case.

What is the ideal scenario in which a trainee transitions from simulation to real-world practices in vascular interventions?

There does not seem to be one "best" application for simulation. We've shown that simulation is a great tool for helping with skills acquisition as physicians start to perform endovascular procedures (ie, early in their specialty training). We have also found that observing performance on simulated cases provides a practical means to assess who has gained the knowledge and skill level to be competent in basic procedures. So for residents and fellows, I think simulation helps in both the early and later stages of training. In addition, several companies have effectively incorporated simulation experiences in their device or procedure-specific training programs, and these are programs that target experienced interventionists.

One particular advantage of simulation is that it offers a way to teach and practice management of complications. Many organizations have adopted training methods and tools developed by the aviation profession, including Crew Resource Management (CRM) (renamed "Crisis Resource Management" when used in medical settings). CRM training—incorporating simulation technologies—trains physicians, nurses, and technologists to work together in response to emergency situations. This prepares the team to work in a coordinated manner in critical situations. CRM training is applicable for physicians and clinical staff at all experience levels.

You have been involved in a few trials combining medical therapy and supplements—most recently the Evaluation of Cilostazol in Combination With L-Carnitine (ECLECTIC) study—for the treatment of intermittent claudication. What can you tell us about the findings from these studies? How are these trials measuring success?

Compared to early studies, such as those done before the Food and Drug Administration's approval of pentoxifylline in 1984, the bar has been raised. Studies of drug therapies for intermittent claudication have become more reliable and more robust, because methodologies have been improved. Carefully standardized treadmill testing provides a validated measure of walking performance in the clinic, but these measures are now routinely supplemented by subjective measures and quality-of-life assessments.

We now have good data showing that cilostazol improves walking ability for many claudication patients, while pentoxifylline has minimal, if any, benefit. Supplementation with L-carnitine, an amino acid that has effects on skeletal muscle metabolism, has been evaluated in several trials as a therapy for claudication but with mixed results. Dr. William Hiatt, one of North America's vascular medicine leaders, has organized the ECLECTIC study to see

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if there is benefit from the addition of L-carnitine to cilostazol for the primary medical management of claudication symptoms. This study is ongoing.

Do you think that these drug/supplement therapies will most likely be used in conjunction with vascular intervention, or perhaps in a stepwise fashion before intervention?

The evidence for benefit of medical therapies for peripheral artery disease is clear. Antiplatelet therapy, lipid-lowering drugs, glycemic control, and treatment of hypertension decrease risk of cardiovascular events and death. Level I evidence supports a trial of cilostazol for treatment with intermittent claudication symptoms. Medical therapies, smoking cessation, lifestyle modifications, and exercise may be sufficient for many peripheral artery disease patients. What's becoming increasingly evident, though, is that many of these measures may also improve outcomes after vascular interventions. Thus, today's standard of care is patient-oriented, not lesion-oriented.

At what point should a claudicant be considered for endovascular or surgical intervention?

In contrast to dealing with critical limb ischemia, for which the indication for revascularization is more clearly established, decisions about whether to offer revascularization for claudication can be complicated, especially when the patient has TASC C or D anatomy. Although uncommon, early procedural complications or late failures can transform a relatively benign problem into a life- or limb-threatening situation.

My practice is to focus first on risk factor modification, exercise, and medical management. I generally consider a procedure for a patient with functionally significant claudication symptoms only after a few-month-long trial of conservative management. Imaging with duplex scanning or computed tomographic arteriography is often useful to stratify patients with favorable anatomy for endovascular intervention versus those better served with surgical bypass, and noninvasive imaging can help with procedure planning for those for whom intervention is elected.

Many people take supplements but do not think about them in terms of vascular health. What can be done to spread awareness about the benefits of vitamins and minerals?

It's important for physicians to help patients make healthy choices. It's also important to help patients understand the relative benefit of the choices they make. Balanced nutrition, limiting dietary fat, and avoiding excess weight are known to be good. Dietary fiber, omega-3 fatty acids, folate supplementation, and perhaps a daily multivitamin may also have measurable benefit. However, megadose supplements, L-arginine, chelation therapy, and many other products for "vascular health" that are touted online or in health food stores can be skipped altogether, as they have no proven benefit and in some cases may be harmful. The most important choices vascular patients can make may be the hardest for many: exercise daily and don't smoke.

What can you tell us about your experience working at NASA? How has this experience affected the way you practice medicine?

Being a part of the space program was a great opportunity afforded to me during my years on active duty with the Air Force. I went to Houston in 1999 to be the Chief of the Medical Sciences Division at the Johnson Space Center. It was primarily a management job, with responsibilities for medical operations support for human space flight, occupational health, and biomedical research programs. I learned a lot from working with the division's great team of physicians, biomedical engineers, and scientists. Of course, as an aviation enthusiast, I really enjoyed my time in the air, as a crew member in NASA's T-38 jet trainers, as a researcher on microgravity flights in the KC-135, and traveling to NASA centers and international partners' facilities.

Working in a "nonmedical" organization, I learned about engineers' approaches to problem solving. The first step was to define the needed capability, then to develop and test potential solutions. In complex systems such as the space shuttle or International Space Station, much of the work examined the relationships between the individual components and the systems they comprised, or interfaces between the human and the machine. Because of the connected nature of the components of these complicated systems, safely implementing change always required communication, coordination, and a process of give-and-take. Watching a shuttle launch is always dramatic and moving, but when you know how many disparate elements have to seamlessly come together, it seems even more amazing.

When I finished my fellowship with Gene Strandness in 1992, my view of vascular surgery focused primarily on the operations I performed. Now, I understand the provision of effective care to be the product of complex systems of care, ones that involve much more than just the physician and patient. Training programs, development of drugs and medical devices, advanced imaging systems, informatics tools, as well as administrative and quality assurance functions, all need to be integrated. The practitioner's technical competence remains necessary, but it is not sufficient. For the benefit of our patients, we need to be team players, working together for individual patients' benefit, while also working together to achieve long-term goals. ■