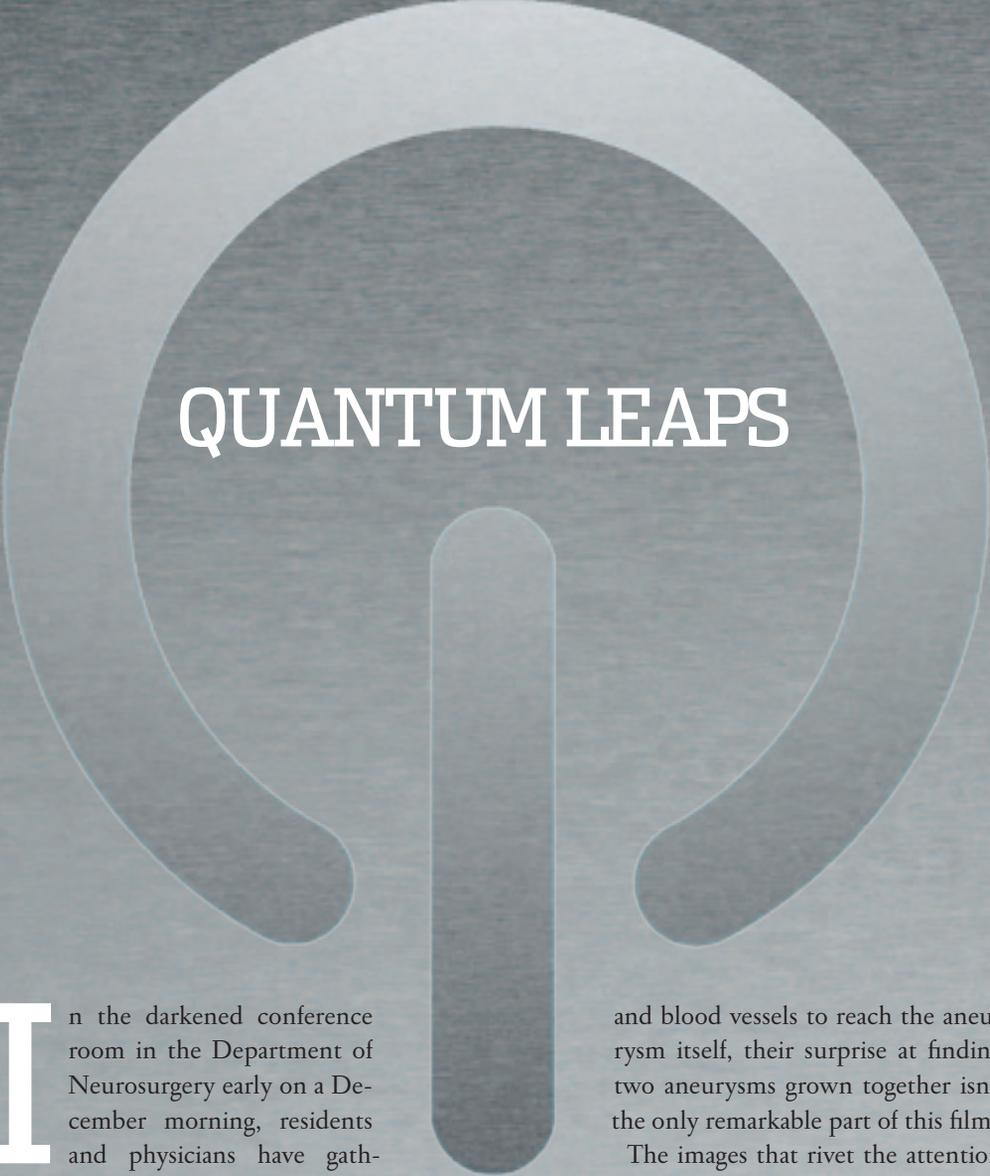




Neurosurgeon Oren Sagher works with TrueVision in the OR

SAFER PATIENT CARE, WELL-BEING OF HOUSE OFFICERS
ARE AT THE CORE OF CHANGES IN RESIDENCY TRAINING.



QUANTUM LEAPS

In the darkened conference room in the Department of Neurosurgery early on a December morning, residents and physicians have gathered to listen and watch as B. Gregory Thompson Jr., M.D., professor of neurosurgery, presents an operation he performed to remove an aneurysm from the brain of a female patient, filmed just a month before and projected on a flat screen in a corner of the room. As Thompson and Chief Resident W. Christopher Fox (M.D. 2003) carefully dissect their way around nerves, nervous structures

and blood vessels to reach the aneurysm itself, their surprise at finding two aneurysms grown together isn't the only remarkable part of this film.

The images that rivet the attention of a roomful of bespectacled onlookers play out in 3-D high definition; the stunning detail and palpable dimensions make for a powerful real-life, being-there experience. TrueVision is a 3-D visualization and guidance platform for microsurgery, which is making its way to a handful of institutions across the country. The demonstration at this morning conference previews the system that

BY RICK KRUPINSKI

has since been installed in neurosurgery operating rooms in University Hospital.

A 3-D surgical camera mounted to one of the oculars of the surgical microscope captures the magnified view the surgeon sees and projects it in real-time for the entire OR staff to view. The live image actually has twice the depth of field provided by the oculars themselves. The procedures can be recorded and the video edited, building archives for future use — for example, at morning conferences.

To Shawn Hervey-Jumper, M.D., a fourth-year neurosurgery resident, dazzling technology like TrueVision is a powerful learning tool. “It’s as though you’re operating,” he says. “Technology can’t replace actually doing it, but it brings it right up to that point. Three-D allows for better planning of approach than 2-D does.”

Traditionally in the operating room, according to Oren Sagher, M.D., residency program director for neurosurgery, there’s a microscope for use by two or three people who can look inside and see a 3-D image, or the perception of dimension. A camera projects the image onto a screen, but it’s like two-dimensional television: A lot of perspective is lost and has to be recreated in the mind. “The value of watching it is better than nothing,” Sagher says, “but far less than being scrubbed and looking into the other oculars. TrueVision is like watching a movie in 3-D. The teaching value is a quantum leap in our surgical education.”

Advanced visualization tools are only the latest way technology supports neurosurgery training. A seven-year residency program, neurosurgery faces many of the same challenges all specialties face. Sagher, also head of neurosurgery’s image-guided surgery and robotics effort and a self-proclaimed geek, is excited about technology’s role in solving some of those challenges.

“The time we have now to teach residents is, frankly, not enough,” he says. “We realized that we needed to make better use of the time we do have. Incorporating computers into teaching over the last decade has been revolutionary. If I look back at how I was trained, more the apprenticeship model, much of what we did then would be illegal now! The amount of time we used to spend in hospitals would be illegal now, too.”

When John Del Valle, M.D. (Residency 1986) did his internal medicine residency in the early 1980s, the prevailing method of learning procedures was “See one, do one, teach one.”

“I’d walk in and watch my senior resident do a paracentesis,” says Del Valle, a gastroenterologist and director of the internal medicine residency program. “Next time she’d say, ‘OK, you do it.’ Not much after that, I’d be teaching the next person. That’s not safe.”

Through the clearer lens of 30 years, that method of learning isn’t all that seems unsafe about medicine of that time.

Residents had long maintained grueling workweeks of 100 hours or more, and concerns grew about the adverse effects on patients of overworked learner-practitioners. Valuable time was lost to inefficient procedures; information wasn’t properly transferred. Patient orders were typically carbon copies of handwritten notes in varying degrees of legibility, sent by systems of pneumatic tubes “into the depths of the hospital,” according to Del Valle. “Sometimes house officers would have to go from the eighth floor all the way down to B1 just to fill out an X-ray request.”

In so many ways, medicine and residency training have undergone a sea change since then, powered by several inexorable forces. Biomedical research has yielded a stunning explosion of scientific information, greatly increasing our understanding of disease and ways to treat it, as well as bringing unimagined complexity to virtually all medical disciplines. This has led to rapid advances in medicine and health care delivery, creating a climate of continual change.

More patients live much longer, often with several chronic conditions requiring multiple medications and highly coordinated care. Meanwhile, concerns about patient safety have mounted over the years, resulting, in part, in the restriction of resident duty hours to 80 per week: considerably less time to learn much more than ever before.

While these medical winds may seem like the making of a perfect storm, there is relative if uneasy calm at the center, the result of innovations in technology, systems, culture, and ways of thinking, teaching and learning.

Patient safety has been a driving force for change in residency training, as well as in health care more generally. In

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2000, the Institute of Medicine issued a report titled *To Err Is Human: Building a Better Health System*, which called for measures to reduce medical errors and improve the quality of U.S. health care. Estimates of patient deaths due to medical errors ranged as high as 98,000 per year at the time.

In July 2003, the Accreditation Council on Graduate Medical Education, acting on public concerns about being cared for by overworked doctors and based on recommendations in the IOM report, restricted the duty hours of residents. A limit of 24 hours was imposed upon continuous duty, with up to six additional hours allowed for transition of care and instructional activities. Ten hours of rest is required between duty periods.

A 2008 report by the IOM addresses concerns about the number of consecutive hours without sleep within the weekly restriction. As a result, further recommendations may be coming that a resident spend no more than 16 hours on continuous duty, followed by a five-hour respite that counts toward the weekly duty-hour total.

Del Valle says, “Duty hour limits are in place for a good reason. I’ve noticed a tremendous transition in the overall well-being and attitudes of young practitioners — much more positive. What used to be in place was difficult to sustain.”

But issues of patient safety go far beyond the problem of sleep-deprived residents. What about those illegible orders and the pneumatic vacuum they went into? What about patient records, transfer of information, and making sure all learners are trained in a consistent manner — especially with today’s fragmented schedules and residents stationed at any number of locations instead of all within one facility as it used to be?

The theme that emerges throughout the solutions is one of “everyone seeing the same thing” — from conferences and lectures and when and where they’re going to happen, to patient information and proper approaches to medical and surgical procedures. Technology has proven a critical key to unlocking the box people can think and learn outside of.

As the ubiquity of the computer spread throughout business and social strata, it found its place in medicine too, first in the operating room to assist surgeons, and then in every nook and niche of clinical care, education and research. CareWeb, providing online access to patient information, and CareLink, an online ordering system that went fully operational in 2008, help ensure clear, consistent information quickly transmitted and easily accessible.

Patients’ electronic medical records (EMRs) allow access to the same information by all members of a care team. Dictation and re-entry of data are reduced, as is associated risk of error. The EMR improves the transition of care between day and night teams, according to Del Valle. “We use the same technology to capitalize on large amounts of information on our complex patients for developing hand-off documents — shared among members of the health care team — and discharge summaries.” Today, the patient can exit the hospital with an almost instant summary of their hospital stay as well as clear discharge instructions in hand. It used to take weeks, recalls Del Valle, before a discharge letter was dictated, typed, signed and mailed to the referring or primary care physician, who in turn was responsible for assisting with the patient’s care after being released from the hospital.

“Technology has helped facilitate the process of safe, efficient care,” Del Valle says, “contributing an infrastructure that assists training programs in meeting their duty hour restrictions. It gives you the ability to access information when you’re not at the hospital — you’re at the VA, in another clinic, at home — you can access data and keep things moving along. Moreover, technology plays an important role in facilitating transfer of information between members of the health care delivery team in a timely manner.”

The many demands placed on residents and faculty mean they are not always able to attend certain conferences such as grand rounds, so these are streamed via the Web for viewing in real time at different locations — or later, when individual schedules allow. Repositories of these videos grow, providing archival access on an ongoing basis. With maximum flexibility, everyone is seeing the same thing, and a “missed” lecture is never missed.

What about “See one, do one, teach one”? How, in today’s environment, do you provide standard training for each resident? In the Department of Internal Medicine alone, that’s more than 160 individuals; there are 795 residents Health System-wide.

First, residents can access — from anywhere, at anytime — a Web-based curriculum that provides full instructional content, complete with a pre- and post-test. Informed, they then move on to hands-on training — not with a patient, but with a mannequin in the Clinical Simulation Center.

Says Del Valle, “One of my associates, Dr. Davoren Chick, worked with faculty members in our simulation center to provide a model for trainees to learn a series of invasive procedures, including phlebotomy and peripheral and central venous lines, before their first patient encounter.” Within circumstances that are fairly close to the human experience, residents are taught, under close supervision, everything from informed consent to utilizing the equipment and completing the procedure.

“While simulation doesn’t substitute for the patient experience,” says Del Valle, “they’ve had a chance to learn and experience a standardized procedure in simulation before

they have to perform it, perhaps emergently, and no patient was put at risk.”

Del Valle and others are quick to point out that technology is not the solution to every challenge. “Technology is wonderful,” he says, “but you need the hands-on experience of talking to patients, examining and caring for them under a supervised set of circumstances. You can’t become a good physician if you don’t have the experiential component in training. It’s our obligation as teachers to make sure that those elements of professionalism and patient ownership and engagement are taught and preserved.”

Over the past five to 10 years the Department of Internal Medicine has seen a 3-5 percent increase per year in the number of patients admitted to its services; last year, more than 18,000 patients were admitted. Yet, the residency program is capped at 160 trainees. Without an innovative program of hospital-based physicians known as hospitalists, that



ever-increasing patient load potentially would fall upon an unchanging number of residents — impossible to accommodate in light of ever-growing patient complexity and significant duty restrictions.

“When I began as program director in 2000,” Del Valle says, “there was no hospitalist program. The Health System has been extremely supportive of the concept. Today we have a robust hospitalist program,” says Del Valle, “and it grows to accommodate the expansion in patient care requirements. The hospitalists have been instrumental in enabling us as a residency training program to meet ACGME requirements while also meeting the expanding needs of our community.”

In neurosurgery as in other specialties, technology helps organize the department and provides standardized learning tools for its 17 residents, from a Web-based curriculum to a Web portal where residents can self-schedule in the OR. Oren Sagher and his colleagues have invested many hours filming operations, editing video, providing voice-over commentary; the result is an extensive archive of procedures that residents can view before entering the OR or Clinical Simulation Center. “You have an electronic record of what the operation should look like and why we do things a certain way,” says Sagher. “The next question is: How do we put that in the residents’ hands?”

To help meet that challenge, the department issues iPods — the large iPod Touch to newer residents, iPod Nanos to the more senior. Even the two-by-two-inch iPod Nano renders a clear view of operative videos from the department’s archives.

Still for Hervey-Jumper, it’s the everyday technology that is most helpful — the online tutorials and quizzes, an online surgical atlas, the video library. “The videos let you see a procedure so that you’re not going in blind. Each time you watch, it makes more sense. I watched the temporal lobectomy video eight times.”

Restricted duty hours may well contribute to the intensity he feels in residency — “You’re at the mercy of everyone else’s schedule” — but Hervey-Jumper, the father of a 2-year old and husband of an anesthesiology resident, also recog-

nizes the opportunity involved. “I like having a life,” he says.

Del Valle admits to concern that more frequent handoffs of patient care from one team to another because of duty hour restrictions increase the potential for errors, and that the continuity of care missed by learners who work for abbreviated periods of time will have a negative impact on their development. “You worry that residents aren’t seeing the continuum that patient care often requires,” he says. “You can do only as much as you’re informed about, especially if you’re busy with patients.”

Sagher has comparable concerns. “It’s not just a matter of training to be able to do the operations, but also the professionalism and the ability to do longer operations. You occasionally have to do an operation that’s 26 hours long. If you’ve never done that in residency, how would you be expected to do it once you’re done? And would you want to be the patient in those cases?”

Sagher cautions about electronic medical records too. The easy availability of immediate information means you’re less likely to keep on top of it, he says. “It reduces the human effort required, and when you reduce the human effort, you can be too late.”

A copy-and-paste function in EMRs poses additional risk for errors and inaccuracies, Sagher says, and can diminish the teaching involved. “When you know everyone has the information, including your professor, and you don’t have to interpret it, you essentially don’t learn to interpret it.”

Far from being a detractor of EMRs, Sagher says they are a big plus to medicine because of their portability, readability and longevity. It’s how they are used — a matter of culture and mindset — that teachers of medicine must keep in mind. New teaching tools require corresponding shifts in teaching and learning methods, and learning to think critically is of paramount importance in the busy, regulated, information-flooded world of medicine and residency today.

“Let’s face it,” Sagher says, “it’s a foot race here. We’re always looking for shortcuts. Whenever we can find something easier and faster, we’re automatically going to gravitate toward that. We need to find those teachable moments and say, ‘We’re going to stop running here; this is important.’” [M]

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