An interview with Brian Baker, Vice President of Regents Health Resources, Brentwood, Tennessee

The coming convergence of imaging and cancer treatment

By Brian Klepper, PhD

Established in 1996, Regents Health Resources in Brentwood, Tennessee, helps hospitals and physicians develop and manage their medical imaging services. Brian Baker's primary focus as vice president of the company is advising practices that are opening new outpatient imaging centers. He helps practitioners make sense of the bewildering array of imaging technologies so they can figure out which is best for them and their patients.

Mr. Baker began his career more than 20 years ago as a diagnostic imaging engineer for Philips Medical Systems, eventually becoming director of that firm's entrepreneurial business group. He has also worked for GE Medical Systems and has served as general manager of Turner Construction's Medical and Research Products Group, assigned to collaborate on national health care reform issues. While holding his radiologic technology license in Florida, Mr. Baker developed and taught clinical education courses in radiology. We spoke with him recently about the direction of imaging in oncology and what he sees coming down the pike.

Community Oncology: You're an astute observer of the state of imaging technology. How would you characterize it now as it relates to oncology?

We already know that accuracy is the key to effective radiation treatment with minimal collateral damage. The current imaging advances for general diagnoses or for defining malignancy offer much greater accuracy than even 5 years ago. These new levels of accuracy are the foundations for the future of radiation oncology treatment. But right now, it's not an exaggeration to say that radiotherapy for cancer is similar to a wind-up toy that runs across a room. It bumps into whatever's in its path until it runs out of energy or it hits something that has enough mass to stop it. And typically, there's damage along the way. Our planning and treatment ability amounts to pointing the toy in the right direction and letting it go. We wait for the results, but without much opportunity to course-correct once the toy is released. I will say however, that IGRT [image-guided radiation therapy], IMRT [intensity-modulated radiation therapy], and DART [dynamic adaptive radiotherapy] offer modest improvements on traditional rudimentary therapy controls and are moving us in the right direction.

So how do you see the industry evolving?

Let's start where I believe we'll be in another 5 to 8 years, when imaging and cancer treatment really converge. In the future, the oncologist will sit in a sophisticated control room. Treatments will be delivered using real-time feedback to control chemicals, such as liposomes, and radiation delivery. Increased computer processing power and artificial intelligence with computer-aided diagnosis software will provide a "dashboard" of real-time physiological and anatomical feedback, and that information will guide the oncologist's treatment and delivery.

Tell us more about the chemicals—liposomes and similar preparations—and how they work with imaging.

These drugs, which are being developed as we speak, will tag the target cells

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and then be remotely activated as the oncologist or AI [artificial intelligence] defines the need. They're very targeted treatments indeed. Imagine being able to "turn on" only as much of the drug as you need to kill the tumor…as you watch it die with real-time imaging! Oncologists will see the tumor functionally and anatomically, then combine chemical treatment with liposomes and

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radiation to tag, treat, and monitor malignancies.

The feedback gained from real-time monitoring of treatment progress will facilitate a new generation of treatment planning and management software. The ability to watch the progress of drugs, noninvasive markers, and radiation—or proton or carbon therapy—will let the oncologist interact directly with the patient's response to the treatment. Eventually, you'll have maps—in this case, outcome databases—that will help you know the precise treatment parameters needed to achieve a desired result. And the AI software will teach itself, improving its performance over time.

Sounds pretty Buck Rogers. How much of this is available today?

Much of it. It just hasn't been integrated yet. In order to get this dynamic information, we need to develop a universal interface engine—that is, communication protocols between the imaging and treatment technologies. Several companies already have this in the works. The challenge is which protocols will become the standard. It's analogous to the competition between VHS and BETA Max to become the video standard. Actually, there are similar standards battles going on right now in several industries: imaging, healthcare Internet technology, and electronic medical records. The advanced imaging software and AI are really in their infancy today, relatively speaking, though several companies currently are perfecting their capabilities.

You're talking about imaging and treatment technologies as complementary. How difficult is it to integrate them?

In many cases, yes, these technologies have become complementary. But that's only when you can get them to talk to each other, which hasn't always been the case. For example, it's now obvious that IGRT, IMRT, and DART are amazing tools for radiation therapy units. By contrast, there are some physics challenges to overcome in order to get proton technology where radiation therapy is today. Proton therapy still requires manual beam attenuation, and there is no integrated feedback. The technology that's developing to provide more control is called "pencil beam scanning" or "painting." This will allow precise control of a very small proton beam, reducing or eliminating the need for manual beam attenuation, and promoting 3D control. It'll probably be 5 years before it's readily available.

Some would argue that, compared to radiation therapy, PT [proton therapy] is just a more expensive approach. But PT provides a payoff through much less collateral damage. Coming technological advancements in PT will make it more clinically accurate and more efficient. These factors, combined with a greater knowledge of PT's benefits and market economics, will help PT become more common in the coming years. Similarly, IGRT is now about where CT was 10 years ago in terms of its ability to provide real-time images during treatment. I expect its capabilities will advance rapidly as more of the processes perfected in CT are applied to IGRT. Many of the tools exist today that we'll use tomorrow. We just have to continue the complex work required to integrate the technologies that may be complementary but have never worked together before.

But proton technology is more than 20 years old, and a lot more expensive without the return on investment. If it really does cause less collateral damage, why isn't it already more widely used?

Actually some of the first PT experiments were done in the late 1950s, but the technology didn't show up in the United States until about 1990 when the first unit was installed. So the theory has been around for more than 20 years, but the function hasn't been around that long. Today there are still fewer than 20 systems worldwide. Several factors have inhibited the proliferation of PT. It's not indicated in every disease because malignancies are not always in proximity to functionally sensitive anatomy. In those cases, traditional RT utilizing IMRT and IGRT may be effective treatments.

If you look at cancer trends worldwide, and then estimate PT use based on today's indications, the world market opportunity is only around a total of 250 units. That need will likely change as PT adopts some of the automation RT has discovered and as pencil beam painting, and then carbon therapy, which are the next steps, are applied. Naturally, people are hesitant to embrace any new and quickly maturing technology. In the US, teaching and research institutions are PT's early adopters, just as they were the first to use MRI and CT. Once the benefits were clearly defined and the costs came down, MRI and CT proliferated. So it's reasonable to believe that PT and its technological advancements will become much more common in the next 5 to 10 years.

Imagine being able to "turn on" only as much drug as you need and watching a tumor die in real-time imaging.

Aren't they incredibly expensive now? What about return on investment?

Yes, but like everything else in health care, it's complicated. Today, a four-gantry proton therapy center costs as much as a small hospital: about $125 million. The cost of PT equipment alone is well over $50 million. An option exists to build smaller centers with only one gantry and one synchrocyclotron. Then the treatment

gantries can be added as needed.

The return on investment varies by site. PT today is reimbursed, on average, at $25,000 per patient. Depending on the number of treatment gantries involved—that is, patient volume—when you combine startup costs and annual operational costs, you could be looking at 10 years to return your initial investment. However, just this year, Medicare increased reimbursement. So that should help. It's also worth noting that the physics behind a 900-ton synchrocyclotron—getting those protons close to the speed of light—takes a lot of space. PT centers may need as much as a city block of real estate.

I agree that $125 million for a PT unit is a big pill to swallow for something whose capabilities are still being discovered. But when you are talking about life and, more importantly, quality of life, a PT unit can—in cases such as a patient with cancer in the spine—mean the difference between surviving as a quadriplegic, having received RT, and surviving to live a normal life, having received PT. And isn't that why we are all in this business?

With the high cost of all this technology and the return on investment considerations, how does the private practitioner compete?

We're seeing more and more requests for partnerships and joint ventures, which can work very well if people are realistic about their expectations and goals. The point is to share not only the risk but the potential opportunity in the technology. Partnerships can be structured in many different ways depending on the practice's needs and the legal considerations. Of course, the challenge is how to take advantage of the new technology without interrupting patient and revenue streams. Unfortunately, there really is no easy or inexpensive answer for this yet. If your technology is too old to accept an upgrade, the only option that allows for an uninterrupted work flow is to build a new facility. Granted, that's expensive and complex, but it allows the new technology to be integrated, and it positions the practice for the future while delivering better service to patients today.

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