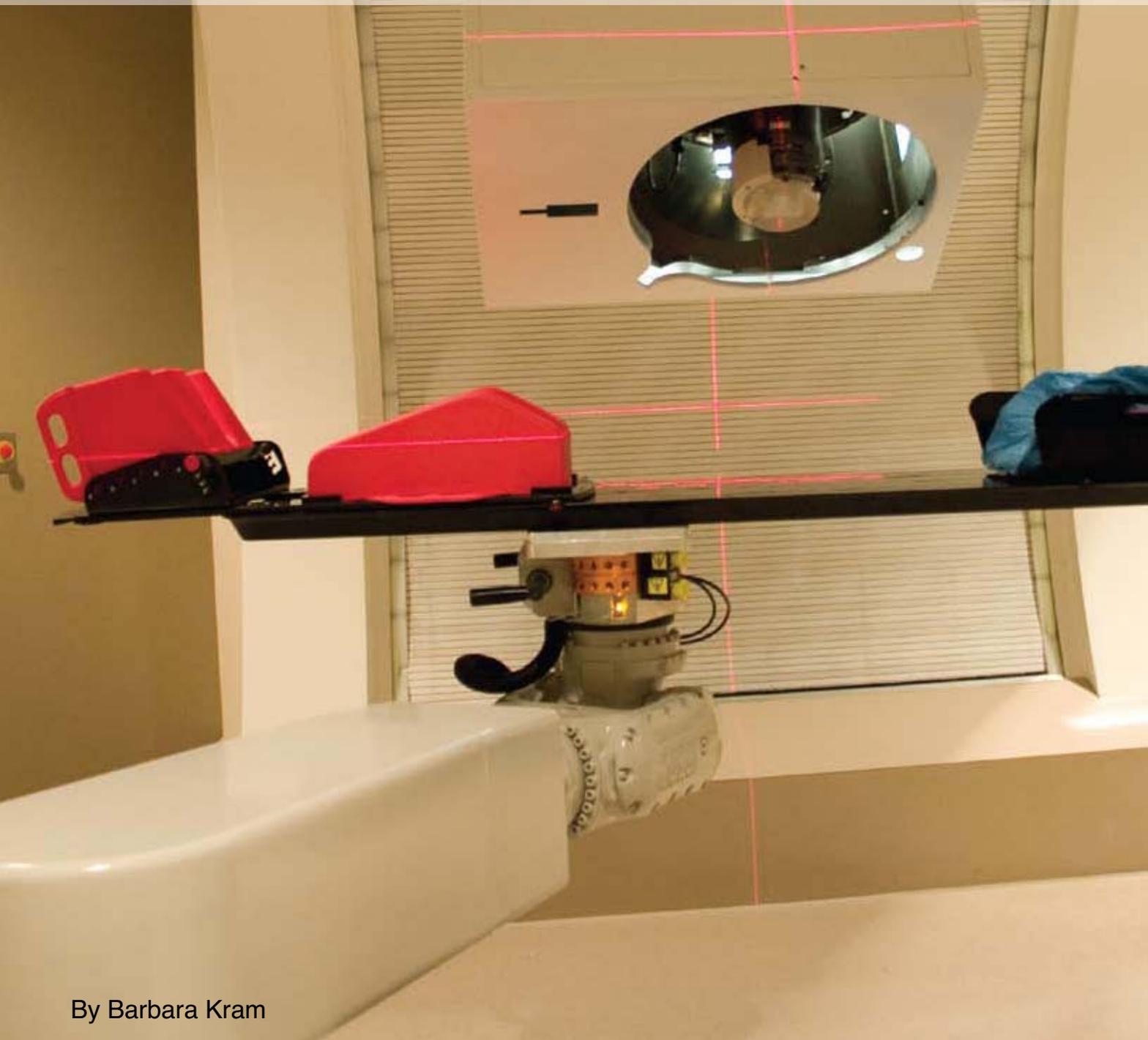


Proton Therapy Update: The Need Never Ends for High-Tech Cancer Treatment Facilities



By Barbara Kram

Despite the economy, 2009 will be a banner year for proton therapy, with two new facilities opening in the U.S. -- the Roberts Proton Therapy Center at University of Pennsylvania Health System and ProCure Proton Therapy, Oklahoma City. The massive projects have been long planned with funding in place for many years. However, newer sites have encountered a few road blocks.



“There are two forces at work. While the financial world is undergoing calamities, the medical world surges forward. There is actually much more interest and demand for proton therapy today than there was even a year ago,” said Hadley Ford, *Chief Executive Officer and Director, ProCure Treatment Centers, Inc.* “The flipside of that is hospitals don’t have as easy access to capital today or their boards want to be prudent in capital plans until they know the effects on operations.”

In addition to its Oklahoma City flagship, ProCure has another fully funded project in the Chicago area - the Proton Therapy Center of Central DuPage Hospital. Two other ProCure projects are under development in Florida and Michigan; a major announcement was brewing at press time (go to www.dotmed.com/news/story/8820 for updates); and yet another proton site is in the offing in the western U.S.

ProCure’s partner in the Detroit area project, William Beaumont Hospital, faces some financial challenges that impact its proton center development; and Florida has land issues. Nevertheless, with so many irons in the fire, Ford is confident.

“We have seen some pressure from hospitals based on their ability to move forward with projects. We think that’s just a cycle and we [will] end up with pent-up demand that will be released once we come out of the recession,” Ford said.

Also scheduled to open this year is the Roberts Proton Therapy Center at the University of Pennsylvania Health System, projected to treat 3,000 patients a

year, including U.S. military personnel in partnership with Walter Reed. Children will be a priority at the institution, a concern and focus at several proton therapy centers including Massachusetts General Hospital and M.D. Anderson.

“We like to treat as many pediatric patients as we can because that is where proton therapy is going to have the most benefit,” said Andrew K. Lee, M.D., M.P.H., Director of the Proton Therapy Center at University of Texas M.D. Anderson Cancer Center, one of the nation’s five operational proton centers. (See sidebar.)

“Kids tend to be more sensitive to late effects of even low doses of radiation and the effects can be pretty profound. If you treat [children’s] brains, not only do they have issues regarding neuro-cognition but any bone you treat to a certain dose is probably not going to grow at the same rate as non-exposed bone. So anything you can do to avoid total radiation exposure to a child but still get at the tumor is just a good thing,” Dr. Lee said.

Technological Enhancements

Compared to conventional X-ray radiation therapy, protons are particles that are accelerated and aimed precisely to target only tumors, sparing nearby healthy tissue.

“Once the protons reach a certain velocity and depth of tissue, they will deposit all their energy over a very finite range. It maximizes the radiation dose deposition right where you want it and perhaps more importantly, there is no dose after that point,” Dr. Lee said. “That is the difference between X-rays and protons. We can stop the protons over a very short distance.”

As advanced as proton therapy is, the approach continues to be refined by medical physicists and doctors to maximize clinical benefit. For example, M.D. Anderson was the first to employ a pencil beam technology in conjunction with its Hitachi synchrotron. This spot scanning approach uses magnets to guide fine proton beams toward a tumor and away from critical structures. Applications include complex of tumors of the prostate, brain, base of the skull and eye.

To explain the technology, Dr. Lee drew the analogy of painting. Protons are



Gantry room installation at the University of Florida Proton Therapy Institute in Jacksonville (Image courtesy of (IBA) Ion Beam Applications)



the paint, but many techniques can apply it—a sprayer, roller, or fine airbrush.

“Conventional protons use a little bit larger spray and block the overspray with an aperture typically made out of brass. That has an opening in it that conforms to the shape of the tumor target. Protons are allowed to pass through the opening and overspray is blocked,” he said. “With the pencil beam scanning, imagine taking away that block and instead of a spray you use an airbrush of protons. You start at the deepest layer and spray one spot, then another until you cover that entire layer; then move up to the next layer.”

A prostate treatment plan, for example, might include two dozen layers and 1,800 to 2,000 spots delivered in about two minutes, controlled by the machinery software in a rapid fire to pre-set coordinates.

Advanced medical imaging provides the visualization to aim protons precisely at tumors. Modalities including 4-D CT, MRI, and PET/CT.

The massive particle accelerator cyclotrons or synchrotrons needed to

perform proton therapy are the reason for the cost—in excess of \$150 million—of building a proton therapy center. However, another type of cyclotron can be employed instead, operating at higher magnetic field strengths so that the accelerators are smaller - about 20 tons compared to 200 tons. This more affordable approach by Still River Systems might transform the proton therapy landscape and market.

Still River Systems is working on the Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine in St. Louis. Other sites under development include Robert Wood Johnson University Hospital, New Brunswick, N.J. and Oklahoma University.

“Our approach greatly lowers the price of entry and cost of proton therapy,” said Lionel Bouchet, Director of Product Management, Still River Systems. “Our model fits very well in what we as a nation need to do, which is reduce expenses and the price of health care.”

A “Radiation Vacation”

It’s easy to see why cancers of the brain, neck or eye are the treated with proton therapy. Additional applications include lung, lymphoma, breast, and anywhere that conventional radiotherapy is employed.

Prostate cancer treatment is a major application for proton therapy. M.D. Anderson, Loma Linda University, and the University of Florida all treat heavy patient loads of about 60 to 110 patients per day with this condition.

“While radical prostatectomy may

be recommended by urologists, patients want to avoid surgery and when they find out about protons, that is what they want,” said Leonard Arzt, Executive Director, National Association for Proton Therapy. He noted that two of the nation’s proton therapy centers are located in attractive tourist destinations, a point not lost on patients. “Patients say that if you are a golfer go to Loma Linda; if you like the beach, go to Jacksonville. They call it a ‘radiation vacation.’ They are outpatients, take their spouses and do whatever they want to do.”

While patients make the best of their plight, several controversies are brewing related to proton therapy. An overall trend toward comparative effectiveness research may require additional investigations into the relative efficacy and cost.

Controversies surrounding proton therapy also relate to allocation. Physicists and clinicians hold that proton therapy is more effective than conventional radiotherapy, so the challenge is how best to use this costly and precious resource.

“Each time someone comes up with a new protocol, that expands the addressable market,” said Ford. “The amount of people who protons can help will increase...and the number of centers isn’t increasing that rapidly. There is a huge supply and demand imbalance today. That will only get worse before it gets better.”

Note: A symposium on proton therapy, sponsored by the American Association of Physicists in Medicine (AAPM), takes place May 8-9 in Baltimore. Watch DOTmed’s continuing online coverage of proton therapy events, issues and topics.

● **Online:** dotmed.com/dm8866

U.S. Proton Therapy Centers In Operation:

- James M. Slater, M.D. Proton Treatment and Research Center at Loma Linda University Medical Center
- Francis H. Burr Proton Therapy Center at Massachusetts General Hospital Cancer Center
- Proton Therapy Center at The University of Texas M.D. Anderson Cancer Center
- Midwest Proton Radiotherapy Institute (MPRI) at Indiana University
- University of Florida Proton Therapy Institute

Under Construction:

- The Roberts Proton Therapy Center at University of Pennsylvania Health System (2009)
- ProCure Proton Therapy Center, Oklahoma City (2009)
- Hampton (VA) University Proton Therapy Institute
- Northern Illinois University Proton Treatment and Research Center Under Development:
- South Florida Proton Center at University of Miami

Source: National Association for Proton Therapy, www.proton-therapy.org