



## Treating breast cancer with protons: patients' perspectives

Studies of proton radiotherapy following lumpectomy for early-stage breast cancer have been ongoing for several years at the James M. Slater, MD, Proton Treatment & Research Center.

In these studies, physicians give protons in a short, two-week course rather than in the longer period (generally six weeks) required for conventional X-rays. Published results show that the treatment is highly effective, both in terms of controlling the disease and minimizing side effects by sparing a great deal of normal tissue.

**These twin outcomes—controlling the disease while minimizing side effects and thus maintaining quality of life—are the whole point of the Loma Linda program.** The stories of two patients illustrate these goals.

### An insider's unique perspective

Vicky Ramirez, of Redlands, California, works at the Breast Health Center at Loma Linda University Medical Center (LLUMC). She relates, "I had worked there six months when I was diagnosed. I was the initial contact for women coming into the center; now I was one of them." Even though Ms. Ramirez works in the field and is familiar with the disease, it was devastating when her doctor gave her the news. "It was December 22, 2005, at 9:45 a.m. I even know what I was wearing," she says. Diligent self-examination led to an early diagnosis, identifying a disease treatable with lumpectomy and proton therapy. "I didn't need chemotherapy and I had no ill effects from the treatment, so I was very lucky." She went on, "Early detection is so important. We've had a number of women in their twenties recently come in, so you can

never assume you're immune." In addition to the friends and family who supported and prayed for her, Ms. Ramirez is also grateful to those who supported research and took part in clinical trials. "There are so many options now and so many resources. We have the patients, the researchers



Ms. Vicki Ramirez

and the doctors to thank," she says.

Ms. Ramirez was one of the 50 women in the first LLUMC trial who received proton treatment. She had no side effects and has been free of cancer since completing her treatments in April 2005. "I'm doing very well," she says. Dr. David A. Bush, of the department of radiation medicine, was her radiation oncologist. Commenting on the trial, Dr. Bush said, "The recurrence rates are low and the survival rates have been excellent. But most importantly, we found that the side effect profile was very good."

The ability to spare so much tissue and thus reduce side effects was especially important in Ms. Ramirez's case. One potential side effect of X-ray treatment is heart attacks later in life because some of the radiation dose reaches the heart. Ms. Ramirez's cardiologist feared that standard radiation would affect her heart valve transplant. But proton beams are different from the X-rays most people are familiar with. Protons are particles that can be stopped within the boundaries at the designated tumor volume. "It's important

that the beam travels just deep enough to treat the tumor but not any farther, to protect the healthy tissues that lie beyond it," said Dr. Bush. Ms. Ramirez said she didn't experience any nausea, swelling or skin burns.

### A patient from the community

Another patient, Ann Hughes, a professional hair stylist who also lives in Redlands, testifies to her satisfaction with the Loma Linda experience. In 2006, Mrs. Hughes's annual mammogram revealed that a mass, which had been biopsied a year earlier and found not to be cancer, looked suspicious. A second biopsy revealed cancer cells. Her first reaction, as with most people, was fear and uncertainty. She shared her news with some of her customers. One asked her, "Have you thought of protons?"

**"Proton beams are different from the X-rays most people are familiar with."**

"Up to then, I'd never heard of proton therapy," Mrs. Hughes said. "But I called Loma Linda and eventually was connected with Dr. Bush's nurse coordinator, who was just wonderful: she spent a lot of quality time with me in discussing the proton breast study; she then asked me if I would like to participate."

Mrs. Hughes was referred first to Dr. Carlos Garberoglio, who performed the lumpectomy and axillary dissection. The operative specimen revealed a small, slow-growing breast cancer, and her axillary nodes did not contain tumor cells. She was then referred to Dr. Bush. "He was very



Dr. Bush and Ann Hughes

thorough, very professional and very reassuring,” she remarked.

When asked to describe her experience, Mrs. Hughes remarked that it was easy. “The hardest part for me was getting fitted for the immobilization form, which they called the pod; I had to stay still for about 45 minutes while it was shaped to fit me.” Dr. Bush amplified: “We fit each patient with a treatment brassiere,” he said. “Patients are placed prone in a cylindrical shell with the upper and lower body being supported and immobilized with foam bead cushions. We immobilize the upper chest and breast areas with expandable foam. It takes a while to make this form, but once it’s made, it’s comfortable for the patient even though it immobilizes her.”

Mrs. Hughes agreed. “Once that form was made, I had clear sailing. I came in every day for two weeks, was there for about a half-hour each time, then went home or to work. The actual treatment probably took only a few seconds.”

Summarizing her experience, Mrs. Hughes remarked, “Everyone was just wonderful: very professional, yet

## “At Loma Linda we think that unnecessary radiation should be eliminated as much as possible.”

very warm. I liked the Christ-centered environment.” The staff, she said, “offered prayer before surgery, but nobody pushed religion. It was a pleasant experience in an awful situation. People care here, which is so important when a person is so vulnerable.” She went on, “At Loma Linda people get it; they know how a patient feels. They have empathy here, and sensitivity.

I can’t say enough about the people at Loma Linda,” Mrs.

Hughes concluded, and added, “I’m very fond of the whole team—my surgeon, medical oncologist, radiation oncologist, nurses, technologists, everybody. I talk about this with anyone who asks.”

### Clinical studies

It has long been known that lumpectomy (removal of the tumor combined with axillary dissection) and postoperative

## “At Loma Linda people get it; they know how a patient feels.”

radiation therapy are effective in controlling early-stage breast cancers. Conventional radiation therapy, however, carries a risk of side effects because some of the radiation dose reaches the heart, lung and/or opposite breast.

Risks in mind, radiation oncologists at the James M. Slater center use proton beams to deliver the radiation. The program is led by Dr. Bush. The results of the trial in the first 50 patients was published in 2011 (Bush DA,

Slater JD, Garberoglio C, Do S, Lum S, Slater JM. Partial breast irradiation delivered with proton beam: results of a phase II trial. *Clin. Breast Cancer* 2011;11(4):241-245). All patients completed treatment. Short-term skin effects were limited to mild radiation dermatitis, and late skin effects were mild and were seen in only three patients. Actuarial five-year overall

survival and disease-free survival rates exceeded 90%. No local failures occurred, and virtually no radiation reached the opposite breast, lung and heart.

Dr. Bush and his colleagues concluded that proton therapy provided excellent results. Because of those results, a second study is nearing completion, and another is planned for patients with minimal axillary-node involvement.

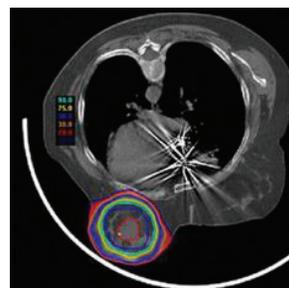
### Medical rationale for proton therapy

Dr. Bush and his colleagues use protons for two main reasons. The first is superior conformability. Dr. Bush notes, “Conformal radiation doesn’t just mean conformation to the target volume. It also means excluding radiation from as much normal tissue as possible.” Dr. Bush went on to say, “At Loma Linda we think that unnecessary radiation should be eliminated as much as possible, not just reduced. Protons give us a tool to exclude much more of the normal tissues than photon-based methods can.”

The other main reason for using protons, Dr. Bush went on, is delivering the total radiation dose in a shorter overall time than is possible with external-beam

X-rays. “We call this hypofractionation,” he said. “It means fewer fractions, or individual proton treatments, with each fraction delivering a greater part of the total dose. The proton beam makes this possible: if we know we can exclude normal structures, we can deliver larger dose fractions without fearing the increased side effects that would happen if we used X-rays.” Dr. Bush elaborated further: “We deliver the total dose, 40 Gray, in two weeks; that’s half the time it would take to deliver that same total dose with X-rays. As our papers have shown, patients have tolerated this treatment very well.”

*Dose distribution (colored lines) of proton radiation of the lumpectomy site (inner red circle). The dose drops off rapidly from the blue line nearest the inner red circle. The radiation dose is confined within the treated breast; no radiation reaches the opposite breast, lungs or heart.*



In fact, the duration of radiation treatments in the LLUMC program is less than half as long with protons as with X-rays. Hypofractionation results in a higher biologically equivalent dose with each fraction delivered. This is true of both protons and X-rays, but because protons confine the dose to the intended volume, the risk of side effects is much lower than if hypofractionated X-rays are used. As a result, the radiation dose can be delivered in two weeks with protons delivered to the tumor site, versus six weeks with X-rays delivered to the whole breast.

### Services for breast cancer patients

Proton radiation therapy is one of several services for breast-cancer patients at Loma Linda. Standard services include screening, diagnostics, treatment and support. High-risk breast cancer services include, besides proton radiotherapy: complex surgeries and reconstruction; clinical trials; combined modality breast conservation strategies; systemic therapy with targeted biological agents; dedicated breast MRI with capacity for MRI-guided biopsy; a nurse navigator program; and a dedicated oncology pharmacist, among other services.

Further information is available at:  
**1-800-protons or protons.com.**