# Proton Therapy FAQ

**Q: What is a proton – and what is proton radiation?**
A: A proton is a positively charged particle found in the nucleus of an atom. The protons used in proton therapy are derived from stripping a hydrogen atom of its electron. Proton radiation is a form of external-beam radiation treatment, delivered by generating a beam that penetrates the body from the outside.

**Q: How do proton beams destroy cancer cells?**
A: When protons interact with electrons in the atoms of cancer cells, they impart energy, which damages the DNA of the cancer cell. This destroys specific cell functions, which include the ability to divide or proliferate. A cancer cell's ability to repair such injuries is frequently inferior to that of cells in normal tissues. As a result, cancer cells die, and so does the tumor.

**Q: How accurate is the delivery of proton beams, compared to X-rays?**
A: Proton therapy is the most precise form of radiation treatment available today. Conventional X-ray treatment beams penetrate well beyond the tumor (because they have no electrical charge, or mass), but protons can be controlled to conform precisely to the shape of the tumor and to release most of their energy within the tumor. Protons stop where the tumor stops, whereas X-rays penetrate entirely through the body. Protons have a lower entrance dose than X-rays, and have no exit dose beyond the tumor, resulting in less damage to healthy tissue. The accuracy of protons enables doctors to treat tumors with a substantially lower total radiation dose to healthy tissue, compared to the latest X-ray therapy.

**Q: Is relatively low-dose radiation exposure to healthy tissue really such a bad thing?**
A: There is never any advantage to irradiating healthy, normal tissue. At some level, you will always create damage. In many cases, that damage may never become clinically apparent. But as we get better at curing cancer and people are living longer after treatment, there is cause for concern about the long-term side effects. For example, a 2013 report in the New England Journal of Medicine analyzed the records of thousands of breast cancer patients who received X-ray treatments to their left breast. The report found these women developed a higher risk for heart disease, which was directly related to the volume of the heart that was irradiated during treatment.

**Q: What types of cancer can proton therapy treat effectively?**
A: Proton therapy is best suited for solid tumors that are 1) localized (i.e., have not spread); 2) situated near sensitive normal tissue; and 3) require high doses of radiation. Specific tumor sites well-suited for proton therapy include breast, lung, prostate, spine, head, neck, brain, gastrointestinal tract and central nervous system, among others. Proton is also recognized as the preferred form of radiation therapy for many pediatric cancers. Because children's bodies are still growing, they are extremely sensitive to the harmful effects of radiation.

**Q: What steps are involved in the patient treatment process?**
A: The first step involves creating an immobilization device to hold the patient in the same position for each treatment. Next comes imaging, which always includes a CT scan and sometimes also an MRI and/or a CT PET scan. This takes about 2 hours and the patient is then free to go home. The imaging data is put into a planning computer, where the physician specifies, slice by slice, the exact areas to be treated. The dosimetrist then creates a plan to meet the physician's prescription goals. Once this plan is approved by the physician, the dosimetrist and

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physicist conduct a series of quality assurance checks to ensure the plan is delivered as intended. Next, the patient returns to the facility to verify physical positioning, and treatments begin the following day. Patients typically receive daily treatments (Monday through Friday) for four to eight consecutive weeks. Patients with certain types of tumors may undergo additional imaging over time, in order to adjust treatment plans to match changes in tumor size.

**Q: What is a typical proton treatment session like for patients?**
A: During therapy, patients feel no physical sensation from the proton beam, hear very little noise and experience minimal discomfort while on the treatment table. Delivery of the proton beam to the patient lasts (on average) only about a minute per treatment field. Time spent in the treatment room is usually about 15 to 25 minutes, for precise patient positioning and equipment adjustments. Afterward, patients are free to go about their daily activities. (Pediatric patients may receive their treatments under anesthesia.)

**Q: Are patients' side effects generally different with protons vs. X-rays?**
A: In many cases, side effects associated with external beam radiation therapy (e.g., diarrhea, headache and loss of appetite) are less frequent and/or less severe with protons than with X-rays. This is because proton therapy spares significantly more healthy tissue than does X-ray therapy. For example, most prostate cancer patients treated with X-rays suffer from diarrhea caused by the radiation penetrating the small intestine. Since proton beams stop at the affected site, this can be avoided. While diarrhea may not seem like a serious side effect, it can be distressing and may result in a change in the treatment program.

**Q: How soon will patients know if their proton therapy was successful?**
A: Long-term success is determined if the cancer does not recur. After treatment, follow-up by a physician is required.

**Q: How does the cost of proton therapy compare to conventional therapies?**
A: From the patient's perspective, there is often no difference in out-of-pocket costs between proton and X-ray therapy, once certain insurance criteria are met (e.g., deductibles and maximum annual payments). From an insurance company's perspective, proton therapy costs more than traditional forms of radiation, but the cost is expected to come down over time as the technology becomes less expensive. In some cases, proton therapy may actually cost less, since protons are more accurate and higher daily doses can be used, resulting in fewer treatment sessions. Proton therapy can also provide long-term cost savings by reducing side effects and cancer recurrence.

**Q: Is proton therapy covered by insurance?**
A: Proton therapy is approved by the FDA and has an established history of reimbursement by Medicare and many private health insurance payers. Specific coverage guidelines vary among commercial insurers. Scripps will work with patients and their insurance providers to assist with the process of determining coverage eligibility.

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