Proton Therapy for Pediatric Patients with Cancer

Talk to your doctor about how Proton Therapy can help you.

Precision Therapy. Fewer side effects.

Proton Therapy is an advanced form of radiation therapy that precisely targets the tumor utilizing proton particles. Proton particles stop inside the body and do not deposit radiation beyond the tumor they are targeting, causing less damage to healthy tissue. Proton therapy is effective in treating a broad range of tumors including brain, prostate, head and neck, central nervous system, lung, breast, sarcoma, gastrointestinal and many pediatric cancers.

Studies show that using proton therapy to control pediatric tumors provides excellent results while reducing damage to healthy tissue and reducing the likelihood of cancers occurring at other sites in the body.[1,2,4]

Visit **Protonbenefits.com** for more information.

What to expect when getting treated

There is no discomfort or sensation during the actual radiation treatment. Most pediatric patients have few, or very mild, side effects from proton therapy. If your child does experience any side effects, they can be managed with medications in most cases. Depending on your child's diagnosis, treatments are usually given five days a week for a period of four to eight weeks. The time spent actually delivering the protons to the tumor is about one minute, but a pediatric cancer treatment session can range from 60 to 90 minutes, depending on the patient's needs. If sedation is required to help keep your child still during the treatment, your appointment will run on the longer side of this range. Most children are able to participate in normal activities before and after treatment.

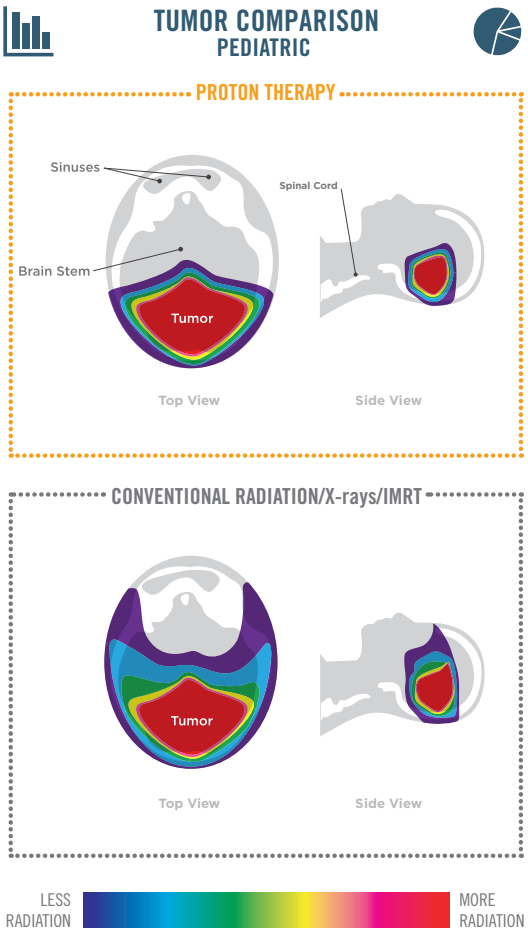
In the chart to the right, the grey/white areas indicate no radiation exposure, while the colored areas indicate radiation exposure.

PROTON THERAPY BENEFITS

Particularly beneficial for children

Since children's bodies are still growing, they can experience more serious short-term and long-term side effects from X-ray radiation than adults. [6,7] Research has shown that proton therapy may significantly reduce the risk of developmental and growth delays, secondary tumors, reductions in IQ and other complications often associated with standard X-ray radiation. This is why proton therapy is often preferred when children need radiation treatment for cancer or other types of tumors.[8] Proton therapy is generally preferred for treating solid tumors in children because it delivers less radiation to normal tissues, which helps to prevent serious complications and causes fewer short- and long-term side effects.[2,3]

- Brain Tumors
- Pediatric Sarcoma
- Lymphomas
- Neuroblastoma
- Retinoblastoma
- Other Rare Tumors



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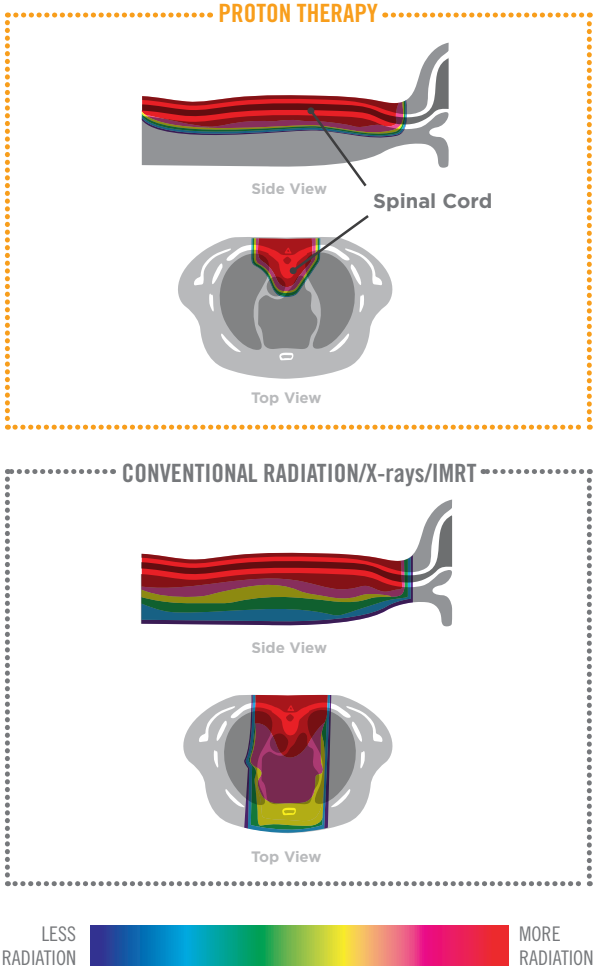
Pediatric Cancer treatment with protons compared to treatment with conventional radiation/X-rays/IMRT

The following diagram shows the difference in radiation dose between protons and the most sophisticated form of X-ray radiation in treating a common pediatric cancer, medulloblastoma. Proton therapy delivers less radiation to the heart, lungs, abdomen and esophagus for pediatric patients with medulloblastoma. Less radiation to these critical organs reduces the likelihood that patients will experience adverse effects years after treatment.[1]

TUMOR COMPARISON
TREATMENT OF MEDULLOBLASTOMA



A number of complications can result with the use of X-ray radiation therapy for pediatric brain cancer. Because the hypothalamus and pituitary gland are close to the site of radiation, the hormones produced by those structures can be affected. These neurohormones stimulate the secretion of growth and thyroid hormones, which are particularly important for normal growth, development and metabolism.[1,4] Children can also be at risk of hearing loss from tumor surgical complications and side effects from chemotherapy and radiation. Doses to the cochlea can be substantially reduced with the use of proton therapy, decreasing the risk of hearing loss.[5]

[2]

TUMOR SITE	Estimated yearly risk of developing secondary cancer in children after receiving protons, X-ray & IMRT for medulloblastoma		
	Proton (%)	X-ray (%)	IMRT (%)
Stomach / Esophagus	0.00	0.15	0.11
Colon	0.00	0.15	0.07
Breast	0.00	0.00	0.00
Lung	0.01	0.07	0.07
Thyroid	0.00	0.18	0.06
Bone / Connective tissue	0.01	0.03	0.02
Blood	0.03	0.07	0.05
All Sites	0.05	0.75	0.43
Relative risk compared to standard X-ray plan	0.07	1	0.60

*This chart compares the rates of secondary tumors for a pediatric patient treated for medulloblastoma.

*Data shown are modified from reference.

*IMRT = Intensity modulated radiation therapy

[1] Lee CT, Bilton SD, Famiglietti RM, et al. Treatment planning with protons for pediatric retinoblastoma, medulloblastoma, and pelvic sarcoma: how do protons compare with other conformal techniques? Int J Radiat Oncol Biol Phys. 2005;63(2):362-372.

[2] Miralbell R, Lomax A, Cella L, Scheider U. Potential reduction of the incidence of radiation-induced second cancers by using proton beams in the treatment of pediatric tumors. Int J Radiat Oncol Biol Phys. 2002;54(3):824-829.

[3] MacDonald SM, DeLaney TF, Loeffler JS. Proton Beam Radiation Therapy. Cancer Invest. 2006;(24):199-208.

[4] Chin D, Sklar C, Donahue B, et al. Thyroid dysfunction as a late effect in survivors of pediatric medulloblastoma/primitive neuroectodermal tumors. Cancer 1997;80(4):798-804.

[5] Merchant TE, Hua C, Shulela H, et. al. Proton versus photon radiotherapy for common pediatric brain tumors: comparison of models of dose characteristic and their relationship to cognitive function. Pediat Blood Cancer 2008; SI:110-117

[6] MacDonald SM, DeLaney TF, Loeffler JS, Proton Beam Radiation Therapy. Cancer Investigation. 2006;(24):199-208.

[7] Miralbell R, Lomax A, Cella I, Schneider U. Potential reduction of the incidence of radiation-induced second cancers by using proton beams in the treatment of pediatric tumors. Int. J. Radiat. Oncol. Biol. Phys. 2002;54(3):824-829

[8] Merchant TE, Hua C, Shukla H, Ting Xiafei, Nill S, Oeike U. Proton versus radiotherapy for common pediatric brain tumors: composition of models of dose characteristics and their relationship to cognitive function. Pediatric Blood Cancer. 2008; 51:110-117

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