Radiation therapy is used widely in the treatment of cancer and some benign conditions. Proton therapy is a newer form of external beam radiation therapy which utilizes positively charged particle beams (Greco & Wolden, 2007). Protons were discovered in the early part of the 20th century. Robert Wilson was the first researcher to propose the use of protons in the clinical treatment of cancer (Wilson, 1946). The first patients were treated in Berkeley, CA in 1954, in Uppsala, Sweden in 1957 and at the Harvard Cyclotron in Boston in 1961 (Tatter, 2006). For 40 years, proton therapy was limited to the research setting. However, advances in imaging techniques in the 1980’s led to the opening of the first clinical facility in 1990 using proton therapy in a hospital-based setting (Smith, A.R., 2006). There are currently nine proton therapy centers in the United States and several more are under construction and in development. Proton therapy is delivered at a sub-millimeter level of precision. Treatment involves physicists, dosimetrists, radiation oncologists, radiation therapists, machinists, engineers as well as nurses in the day-to-day activities of a proton center. The advantage of proton therapy is the ability to deliver more energy to the tumor while reducing the dose of radiation to critical structures such as the bowel and bladder in prostate cancer and the hypothalamus and cochlea in pediatric brain tumors (Slater, Rossi, and Yonemoto, 2004; Merchant, Hua & Shukla, 2008). (See Figs 1 and 2) Protons offer this advantage because they are charged particles. Protons deliver their energy in a very precise manner when compared with other forms of external beam radiation. The dose of ionizing radiation is greatest at the targeted area and this is called the Bragg peak. There is a lower dose of radiation delivered to the structures proximal and adjacent to the target site and virtually no exit dose (DeLaney and Kooy, 2008). The main benefit of proton therapy is the ability to deliver a lethal dose to tumors while sparing normal, healthy tissues nearby and limiting late effects.

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Because of the reduction of radiation dose to surrounding tissues, proton therapy is used frequently in the treatment of brain and spine tumors in adults and children. Other benefits of proton therapy include fewer short and long term side effects as well as fewer secondary malignancies than standard or photon therapy (Chung, Keating, Yock & Tarbell, 2009; St. Clair, Adams & Bues, 2004).


The Role of the Nurse in Proton Therapy
There are many aspects of the nursing role in proton therapy which are similar to photon therapy. Treatments last an average of 30-40 days. Nurses guide patients and families through the process: gathering records, setting up initial appointments and providing navigation through the treatment planning phase. Nurses provide initial and ongoing patient education regarding possible side effects based upon disease site and planned treatment. Nurses monitor patients closely for skin reactions, fatigue, pain, stomatitis, bowel, bladder, sexual and psychosocial effects among others and provide individualized supportive care (Haas, Hogle, Moore-Higgs & Acomb, 2007; Feight, Baney, Bruce & McQuestion, 2011). However, there are additional unique roles for the nurse in proton therapy. Many centers operate two shifts in order to maximize this limited resource and bring the benefits of protons to more patients.

Additional patient education is required surrounding the longer, more complex treatment planning process; for example, patient unique apertures and compensators are milled to shape the beam and control the depth of the beam and a significant amount of time is required for the construction and testing of these devices (Lomax, Bortfeld & Goitein et al, 1999). Treatment times also differ in proton therapy and patients can be on the treatment table for 20 minutes to an hour or more depending upon the complexity of patient positioning and the number of fields being treated. Prostate marker placement (ultrasound-guided) is done in some proton therapy centers and nurses are involved in providing education as well as assisting with the procedure.

Patients receiving proton therapy often travel great distances from home due to the limited numbers of these facilities. Therefore, nurses assist patients and families with needs for lodging and transportation utilizing organizations that can provide financial support. Social workers and
financial counselors also play an important role in this process. Nurses frequently assess patients for adequate social support throughout treatment. Some proton centers provide activities for out of town patients in order to help them adjust to being away from family and friends and help them build a support system during treatment. Nurses participate in the clinical research process. Many proton centers participate in registry and treatment clinical trials in order to advance the body of knowledge. Along with physician colleagues, nurses participate in informed consent, determine patient eligibility, collect data, grade and report toxicities, collect quality of life data and orchestrate long term follow-up of patients. Nurses play a key role in the management of pediatric patients and work closely with child life specialists, as well as other members of the care team to encourage developmentally appropriate communication and coping strategies. Proton centers work closely with organizations like the Ronald McDonald House, the Treasure Chest Foundation and the Make-A-Wish Foundation in order to meet the unique needs of children. Many children receive concomitant chemotherapy and require frequent communication with other care providers. Nurses also provide anesthesia care to some pediatric patients. All children are assessed individually but many children 6-8 years old or younger require general anesthesia for treatment. These patients have central lines placed since daily IV access is needed. Nurses provide education for parents as well as assessment and monitoring for the children. Nurses must be knowledgeable regarding airway management and patient positioning to protect bony prominences (Algren & Arnow, 2007). Malignant hyperthermia is a rare and life-threatening, hereditary condition that can occur with general anesthesia and involves rapidly rising fever, rhabdomyolysis and risk of
renal failure (Rosenberg, Davis, James, Pollock, & Stowall, 2007). Treatment requires rapid intervention from everyone on the care team.

In conclusion, nurses in proton therapy centers are on the cutting edge of innovations in treatment and are creating exciting, new opportunities for the oncology nurse. The oncology nurse with knowledge of the role of proton therapy in the treatment of cancer is better able to provide education to patients regarding the range of treatment options.

References


