

PROTON BEAM THERAPY: IS IT WORTH THE COST?

Hailed as a breakthrough in cancer treatment, proton beam therapy is an emerging tool in oncology's armamentarium. This treatment modality has been touted by some as the new wonder-weapon in the fight against cancer. One certain wondrous aspect associated with it, is its price tag, with proton beam therapy being much more expensive than conventional radiotherapy, a mainstay cancer treatment. The question thus beckons, is proton beam therapy worth it?

Conventional radiotherapy is a radioactive shotgun of sorts, indiscriminately scattering radiation at the tumor as well as healthy surrounding tissue. Alternatively, the proton beam can irradiate tumors more precisely and spare the healthy tissue from radiation induced damage, thus theoretically lower the risk of side effects; the most worrisome of these, development of radiation induced secondary malignancy, a late complication associated with radiotherapy that can appear decades after treatment. There is some evidence that use of proton beam therapy can decrease the incidence of radiation-induced cancers. (4,8).

Conceived by Dr Robert R Wilson in the 1940s, proton beam therapy has steadily matured, with the first patient receiving proton radiation in 1954, the first concerted proton beam program begun by Harvard University in 1961, and the first hospital-based program established by Loma Linda University in 1991. The therapy received FDA approval in 1988. (1). Since then, centers offering this therapy have proliferated; currently 26 centers operate in the US and another 11 are under development. (9).

The costs associated with proton beam therapy are indeed high. An institution can spend 30 to 200 million dollars to create a proton beam center (Lee, 2014). These institutions of course, expect or at least hope for a return on their investment, and reimbursements are enticing.

A Serize MPH, PA-C. *Proton Beam Therapy: Is It Worth the Cost?*
MJOTA 2018 v12n1 p0310

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According to Yu et al., the median Medicare reimbursement for prostate cancer treated with PBT was \$32,428 versus \$18,575. (10).

Does this targeted and more costly approach translate into better outcomes however? The data delivers some surprising results. To attempt an answer, a literature search of limited scope was undertaken via PubMed, examining clinical trials comparing proton beam therapy to conventional therapy for 5 different types of cancer.

In their widely cited study, Yu et al, looked at patients receiving treatment for prostate cancer and found no difference in side effects between conventional therapy to proton beam therapy at 6 and 12-months post intervention. (10).

Patients with Stage I breast cancer had less skin toxicity, defined as good or excellent cosmesis (94%) after being treated with photon-based therapy; those receiving proton beam therapy did not fare as well (62%). Of note, local failure rates for both treatment groups were similar. (3).

At interim analysis, Bush et al. found that patients with hepatocellular carcinoma treated with proton beam therapy experienced less hospitalization days than those administered

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transarterial chemoembolization, this finding was possibly due to less toxicity; survival rates were similar. (2).

Ojerholm et al. compared proton beam therapy with conventional radiotherapy in patients with anal cancer. As expected, proton beam therapy delivered less radiation to surrounding healthy tissue. The authors cautioned that this finding does not yet portend any clinical benefit. (6).

In patients with intracranial germ cell tumors, researchers found that therapy with the proton beam spared more surrounding brain tissue than two other non-proton modalities. Brain tissue sparing is especially important when dealing with intracranial tumors and these results will perhaps translate into improved outcomes. (7).

Given the above results, clear evidence of the superiority of proton beam therapy over conventional therapy is yet to be fully gathered. Even the evidence for reduced toxicity with proton beam therapy is scant and appears to some extent, theoretical at this stage. No doubt many more trials are needed and perhaps these will clearly elucidate the superiority of the proton beam. One wonders however, if hospitals should exercise more caution before jumping into the proton beam fray, lest they fall into an expensive quagmire that will only deliver diminishing returns for patients and healthcare at large.

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