

The Finnish Experience in BNCT

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Boron neutron capture therapy (BNCT) is based on the nuclear capture reaction that occurs when non-radioactive boron (^{10}B) is irradiated with neutrons of thermal energy to yield high energy alpha particles ($^4\text{He}^{2+}$) and recoiling lithium (^7Li) nuclei with path lengths of approximately one cell diameter in tissue. Thus the effect of α and ^7Li is primarily limited to boron containing cells. Successive BNCT is dependent upon a selective uptake of sufficient amounts of ^{10}B into cancer cells. The uptake may be demonstrated with BPA- F PET imaging prior to BNCT. We have evaluated BNCT using boronophenylalanine fructose (BPA- f) as the boron carrier in the treatment of malignant gliomas and inoperable, locally recurred head and neck cancer. Cell studies and healthy tissue irradiation tests were performed before the clinical studies were implemented.

More than hundred patients diagnosed with glioblastoma or head and neck cancer have been treated at the Helsinki University Central Hospital/VTT BNCT facility since May 1999. The clinical trials are presented at www.clinicaltrials.gov (search word BNCT; look for BNCT protocols; BNCT in the treatment of glioblastoma multiforme, BNCT in the treatment of recurred HN cancer, BNCT in the treatment of recurred glioblastoma or astrocytoma grade III). For excellent BNCT management Boneca Oy was founded (www.Boneca.fi) operating in close collaboration with Helsinki Central University Hospital.

In the head and neck cancer trial (first 12 patients) BNCT was effective and fairly well tolerated when given twice 5- 8 weeks apart with BPA-f 400mg/ kg in 2 hours. Ten (83%) of the patients responded to BNCT and 3 patients have a long term response lasting over 2 years so far. The protocol was expanded to 30 patients.

Most patients with inoperable, locally recurred head and neck cancer respond to BNCT despite having been treated with prior conventional radiotherapy or chemoradiotherapy. Few patients may become long-term survivors. In future protocols the efficacy and safety of BNCT will be tested in combination with chemotherapy or with targeted agents.