AccuBoost – non invasive, real-time, image guided breast boosting

A new treatment option for the boost dose as part of the Whole Breast Irradiation treatment after breast cancer

AccuBoost is a new system designed to allow non-invasive image-guided breast brachytherapy, or NIIGB. The new system includes a specifically adapted mammography station, a CR reader, a series of tungsten applicators and tools for applicator selection and positioning. The radiation source is the HDR microSelectron afterloader from Nucletron. This new system was designed specifically to address the practical and clinical issues in delivering the all-important boost dose, after whole breast irradiation as part of the care of women undergoing Breast Conserving Therapy (BCT) for early stage breast cancer.

Experience in a variety of clinical settings in the United States shows that AccuBoost can be easily implemented. In addition to providing a potential replacement for linac-based electron boost therapy, radiotherapy departments have the opportunity to optimize department resource efficiency by making greater use of their HDR afterloader and at the same time free up Linac time. The AccuBoost system is being introduced to the European market this year, offering a new option for delivering the boost dose.

Boost dose in breast cancer – clinically important, but is the target always reached?

Choosing the right breast cancer treatment depends on the patient. What works for one person may not work for another. After a lumpectomy (removal of breast tumor and a small portion of surrounding tissue), patients commonly require some type of radiation treatment to ensure any cancer cells that may remain after surgery are destroyed. Traditional radiation therapy involves six weeks of treatment, irradiating the entire breast. In many patients, an additional boost dose is provided to the tumor bed (i.e. the tissue surrounding the tumor itself, prior to removal). Several large scale studies have shown that the use of this boost results in a significantly lower risk of cancer recurrence in the same breast, particularly for younger patients.1

However, targeting the boost is not always as straightforward as it may seem. One group in the United States took a close look at how accurately the boost dose (using electrons) was being delivered to the target area, and found that in around 50% of the cases, the target site was missed.2 Use of clinical examination to define the tumor bed, for example based on the location of the surgical scar or palpation, often proves difficult, as does the use and interpretation of ultrasound. The use of CT to define the tumor and develop radiotherapy treatment plans is widely applied in the clinical setting. However, a recent study showed that the volume of breast tissue receiving radiation dose after CT-based treatment planning is significantly greater compared to simulator-based plans.3 Greater exposure of healthy breast tissue leads to greater potential for later complications such as fibrosis of the breast tissue. In turn, this leads to less satisfactory outcomes in terms of cosmesis – the appearance of the breast itself as well as the skin.

An important clinical challenge therefore is to be able to target more precisely the boost volume (i.e. the tumor bed and surrounding area) as well as to minimize the exposure of healthy breast tissue to the relatively higher radiation dose delivered during the boost.

AccuBoost – non invasive, real-time, image guided breast boosting

AccuBoost is a new system which has been developed to allow non-invasive image-guided breast brachytherapy (NIIGB). With real time, image guided boosting, the aim is to target the tissues at risk and so achieve the desired local control, whilst limiting the irradiation volume of normal breast and sparing of healthy skin, tissues and chest organs.

2 Benda RK et al. Cancer. 2003 ; 97 (4) ; 905-909
3 Al Uwini S, et al; Radiother and Oncol. 2009; 93: 87-93
The basic principles of AccuBoost are very simple, and combine the core aspects of mammography and brachytherapy. The specially adapted mammography station is used to compress and immobilize the breast. Real-time images can be taken and used to precisely define the tumor bed and area to receive the boost dose. At the same time, the breast is immobilized, which means that some of the set up and patient movement issues that are encountered with electron boosting are essentially removed. Based on real-time images obtained, the operator can select and position the appropriately sized applicator to deliver the boost dose, accurately and reliably to the target area around the tumor bed. The radiation dose is provided by a high dose rate iridium source via the specially design applicators. Because the breast is lightly compressed, the radiotherapy is delivered to the target tissue with much of the healthy tissue moved out of the treatment field. By dividing the irradiation dose across two axes, AccuBoost results in a composite dose to the target – i.e. at depth in the breast. This same approach results in the radiation dose to the skin being lower than the dose at the target. This in contrast to boosting with electrons, for example, which typically target the beam using an “en face” approach, in other words directly at the chest wall. This results in delivery of “unnecessary radiation to healthy tissues and structures, such as skin, heart and lungs.

The AccuBoost design gives the radiation oncologist the needed confidence that “you see what you treat and you treat what you see”. Besides the clinical benefits of an accurate and non-invasive breast irradiation, use of the system can free up precious time for the LINAC, as well as allowing departments to optimize the use of an afterloader. Taken together, these provide the opportunity to enhance the effectiveness and patient flow in a radiotherapy department. In the United States AccuBoost has been successfully used since 2007 in more than 35 oncology centers. AccuBoost is currently being introduced to Europe, and has been installed in the first centers in Italy and Spain.

Clinical Experience with AccuBoost
Results of assessment of the ability of AccuBoost to target the boost volume and spare exposure to healthy tissues and organs were recently reported in a publication in the International Journal of Radiation Oncology Biology and Physics, or The Red Journal. Researchers from Tufts University School of Medicine used a sophisticated method to model and compare compared dose parameters of AccuBoost with conventional electron boost. The Tufts group also compared dose parameters of AccuBoost with 3D CRT, in terms of partial breast irradiation treatment.

A key finding of the study, performed in 8 patients who had undergone lumpectomy for early stage breast cancer, was that the amount of breast tissue targeted to receive the boost dose, the so called planning target volume or PTV, was significantly lower with AccuBoost than with conventional electron boost. However, key dosing benchmarks were maintained – in other words, the reduction in PTV and sparing of healthy tissue was not at the cost of delivering the necessary dose of radiation to the target. At the same time, the dose delivered to the skin was significantly lower with AccuBoost than with electron boost. Dose to the chest with AccuBoost was one seventh of the dose with electron boosting – dose to the heart was one eleventh with AccuBoost of the dose with electrons.

“Tumor bed boost is a critical component of successful breast conserving irradiation but typical boost techniques have barely evolved in the past 10-20 years.” states Shirin Sioshansi, MD and lead author of the article. “When you combine the paucity of advancements in this area with the papers assessing that CT based targeting may not be as good as we think, NIIGBB becomes of keen interest. We must rethink the entire process of breast tumor bed dose so that it is delivered with the highest possible degree of accuracy and efficacy.” “The localization accuracy and immobilization of the breast allows for minimal margin expansion of the target volume,” according to Dr Shioshansi.

6 S. Hamid1,2, D. E. Wazer1,2, et al, abstract accepted for presentation at the 33rd Annual San Antonio Breast Cancer Symposium, December 2010.
The first results from the US 'AccuBoost Patient registry will be presented at the 33rd Annual San Antonio Breast Cancer Symposium, December 2010. 6

The registry has accumulated data from 9 US institutions that have shared their experience in treating their patients (n=112). The primary purpose of the registry is to assess the feasibility, implementation and early observations of patients treated with AccuBoost. The major finding in the registry is the substantial reduction in higher grade skin toxicity, as well as the good to excellent acute cosmetic results in all patients enrolled in the registry. Among other findings of the registry is the average time required to treat a patient. The mean treatment time is in the order of only 16 to 17 minutes. These first preliminary registry outcomes suggest that AccuBoost is associated with a favorable normal tissue reaction and good early cosmetic results.
Picture: Accuboot system
About Nucletron

Nucletron provides state of the art radiotherapy solutions for cancer treatment that meet the evolving needs of patients, their caregivers and healthcare professionals around the world. Nucletron has unmatched global leadership in brachytherapy, a very precise, highly effective and well-tolerated treatment option for healthcare providers, tailored to the needs of individual patients. We work with clinical teams to constantly improve and develop an innovative portfolio of integrated products, software and services that assures excellent patient outcomes. Headquartered in Veenendaal, The Netherlands, Nucletron employs more than 500 employees, with offices in 15 countries, and products available in more than 100 countries around the world. Please visit www.nucletron.com to learn more about our healthcare solutions.

For further information:

Nucletron
Mark van Braak
Marketing Communications Manager
Email: mark.vanbraak@nl.nucletron.com
Tel: +31 (0) 318 557 255