Implantable marker facilitates use of hypo-fractionated radiation in early breast cancer
Michael Cross1, Joe Ross2, Scott Jones3, Arnold Smith2, Thaddeus Beck2
1Breast Treatment Associates, Fayetteville, Arkansas; 2Highlands Oncology Group, Fayetteville, Arkansas

ABSTRACT

BACKGROUND: Most centers of radiation therapy (RT) have advantages for patients and could result in significant cost-saving for the healthcare system. The majority of patients undergoing breast conservation therapy (BCT) receive whole breast irradiation (WBI) plus a boost to the tumor bed. Each patient’s case was reviewed and discussed at multidisciplinary tumor board meetings. Decisions regarding radiation regimens were optimized based upon the radiation oncology team’s assessment of each patient’s risk factors and tumor characteristics, and dose plans for each patient were generated (Conventional WB, Canadian/HFRT, or APBI) and ultimately selected according to standard ASTRO guidelines.

RESULTS: Routine use of this 3-D marker implant provided a consistently clear visual case for identifying the surgical tumor bed. Improved confidence in targeting led to an increased use of “field in field” planning for RT. Improved planning & targeting enabled increased use of hypo-fractionated RT.

DISCUSSION OF RESULTS
We noted a significant shift from conventional WB to hypo-fractionation over the course of the three year period. This shift was driven by our heightened confidence in targeting due to the presence of the 3-D marker surgically placed at the tumor site. Increased confidence in targeting enabled frequent implementation of field-in-field planning (using multi-leaf collimator) to improve dose homogeneity in well tailored target volumes employed in the accelerated regimens. Currently, over 90% of our patients implanted with the marker are candidates for hypo-fractionated RT which has resulted in a 25% cost savings in their treatment. Cosmetic results in all patients were excellent, and there have been no device-related complications.

REFERENCES

Intraoperative slicing and placement of 3-D marker

MATERIALS & METHODS
Following informed consent, 110 3-D surgical markers were surgically implanted at the tumor bed excision site in 109 patients during partial mastectomy (PM). All patients received a comprehensive pre-operative workup including mammography, ultrasonography, MRI, minimally invasive biopsy, and were localization. Sizers were used intra-operatively to assess the dimensions of the excision site. In each case, the implant size was determined, and the implant was then sutured to the site of the tumor bed, securing it to the adjacent margins at multiple locations using at least 4 interrupted sutures. Tissue flaps were created to relieve skin tension and ensure complete coverage of the implant, and a multi-layered closure was performed.

Each patient’s case was reviewed and discussed at multidisciplinary tumor board meetings. Decisions regarding radiation regimens were optimized based upon the radiation oncology team’s assessment of each patient’s risk factors and tumor characteristics, and dose plans for each patient were generated (Conventional WB, Canadian/HFRT, or APBI) and ultimately selected according to standard ASTRO guidelines.

Cost analysis was performed by collecting available information at our institution for RT on 23 patients who underwent conventional 6 week RT and on 23 patients who underwent hypo-fractionated RT (46 total).

CONCLUSIONS
There was a significant cost savings associated with hypo-fractionated vs. conventional whole breast RT, averaging 25% savings in our practice.

BACKGROUND
The majority of patients undergoing breast conservation therapy (BCT) receive whole breast irradiation (WBI) plus a boost to the tumor bed. Currently, this is the accepted standard of RT for most patients worldwide. However, there is widespread interest in more advanced techniques, such as hypo-fractionation and/or accelerated treatment regimens. These methods are attractive for many reasons, most notably, decreased time for patients to complete their treatment (thereby reducing the arduous nature of a six-week, daily course of radiation) and the opportunity for significant cost savings to the healthcare system.

One factor that has hindered adoption of these techniques is the difficulty in accurately targeting the surgical site in order to maintain tight parameters for determining target volumes. In many cases, uncertainty or ambiguity in visualizing the location of the tumor bed leads to target dose volumes that are too large to treat in an accelerated manner, without having concern for an increase in toxicities. Improved targeting for breast RT is essential in order to take full advantage of current technologies available for planning and delivery of the RT regimen and, therefore, a method or tool that could be easily and clearly visible on CT for RT planning and delivery, might prove useful in enabling use of advanced RT regimens.

Current methods for marking the tumor bed are fraught with uncertainty; thus, we studied a new marker for its potential to provide a more standardized and reliable method of identifying the region of the tumor excision site within the breast.

RESULTS:

In all patients, the marker was easily visible and in 95.7% of cases, it was found to be useful during radiation treatment planning for RT target delineation. 36.8% of patients received conventional full-course whole breast irradiation plus boost, and 4.3% received accelerated partial breast irradiation. 36.8% of patients received conventional full-course whole breast irradiation plus boost, 56.6% received hypo-fractionation plus boost, and 4.3% received accelerated partial breast irradiation. With routine use of the device we observed an unanticipated increased use of hypo-fractionation and/or accelerated regimens resulting in a 25% cost savings per patient over 90% of our patients implanted with the marker are candidates for hypo-fractionated RT.

Trend toward hypo-fractionation over 3 years

Array of marker sizes and CT views of 2cm marker used in dose planning

CONCLUSIONS

Each marker possesses the potential to provide a more standardized and reliable method of identifying the surgical tumor bed. Increased confidence in targeting due to the use of hypo-fractionated RT and/or accelerated regimens facilitates use of advanced RT regimens. Using multi-leaf collimator improves dose homogeneity in well tailored target volumes employed in the accelerated regimens. Cosmetically, results in all patients were excellent, and there have been no device-related complications.

REFERENCES