The cost-effectiveness of proton therapy hypofractionation for regional nodal irradiation in non-metastatic breast cancer

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BACKGROUND AND PURPOSE

Regional nodal irradiation (RNI) for early-stage breast cancer (ESBC) patients yields improved clinical outcomes but increases the mean heart dose (MHD), which correlates with cardiovascular events. Proton therapy reduces the MHD, but its cost may be prohibitive. Hypofractionation (HF) may resolve cost barriers. Cost-effectiveness analyses provide insight into the potential value of proton vs photon HF-RNI and may inform trial design for their comparison.

PATIENTS AND METHODS

A Markov cohort simulation model was designed to explore the cost-effectiveness of proton vs photon HF-RNI from the payer perspective in 16 fractions for patients with non-metastatic breast cancer (NMBC), assuming similar outcomes to conventional RNI (C-RNI).

In the base case, patients age 50 years entered the model after radiotherapy and could develop local or distant recurrence, coronary heart disease (CHD), or death. (Figure 1)

The Framingham risk calculator informed CHD risk, which was modified by the MHD.

Subgroup analyses based on primary laterality, relapse risk, and age were performed. (Darby, NEJM, 2013; Taylor, IJROBP, 2015)

Patients with photon HF-RNI were eligible for cardiac-sparing DIBH.

A willingness-to-pay threshold of $100,000/QALY was used.

Two costing strategies were utilized: (1) CMS reimbursement in the base case and (2) a conservative societal strategy incorporating the capital per treatment cost of the proton and photon facilities.

RESULTS

Table 1 illustrates the calibration of the model predictions with goals.

Proton RNI was not cost-effective in the base case nor in women with right-sided cancers.

Proton RNI was cost-effective ($67,490/QALY) for women with left-sided cancers, particularly in left-ESBC (stages I-II) ($60,664/QALY).

Table 2.

CONCLUSIONS

1. HF-RNI is not currently the standard of care but is under active investigation.

2. If HF-RNI proves to yield equivalent outcomes to C-RNI; this analysis suggests HF-RNI with proton therapy would be cost-effective and supports its further investigation.