



Patterns of care and impact of brachytherapy boost utilization for squamous cell carcinoma of the base of tongue in a large, national cohort

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ABSTRACT

PURPOSE: The National Cancer Data Base was analyzed to evaluate the patterns of care and impact of brachytherapy (BT) boost on overall survival (OS) for patients with squamous cell carcinoma of the base of tongue.

METHODS AND MATERIALS: Patients with nonmetastatic squamous cell carcinoma of the base of tongue between 2004 and 2012 who received concurrent external beam radiation therapy (EBRT) and chemotherapy with or without BT boost in the definitive setting were queried. Overall survival was assessed by the Kaplan-Meier method. Cox regression analysis was used to identify covariates that affected OS.

RESULTS: There were 15,934 patients included in this study; 137 (0.9%) received EBRT + BT and the remaining received EBRT only. Median followup was 41.2 months. The utilization of BT boost declined from 2.1% in 2004 to 0.2% in 2012 ($p < 0.0001$), whereas intensity-modulated radiation therapy use increased from 22.8% in 2004 to 69.2% in 2012 ($p < 0.0001$). The three- and 5-year OS was 83.2% and 78.3% for patients receiving EBRT + BT compared with 77.4% and 69.0% for those receiving EBRT only ($p = 0.03$). The difference in survival was significantly better among patients with T3-4 tumors with EBRT + BT boost ($p = 0.009$) however, there was no survival benefit among patients with T1-2 tumors ($p = 0.72$). The analysis was repeated with patients who received intensity-modulated radiation therapy vs. EBRT with BT boost and the survival difference was sustained only for those with T3-4 tumors ($p = 0.02$).

CONCLUSIONS: Brachytherapy boost has decreased in its utilization even though it was associated with favorable survival outcomes particularly among patients with higher T-stage tumors. © 2017 American Brachytherapy Society. Published by Elsevier Inc. All rights reserved.

Keywords:

Brachytherapy boost; Base of tongue; Squamous cell carcinoma

Introduction

Carcinoma of the base of tongue (BOT) accounts for 30% of oropharyngeal cancers and lymph node metastases

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are present in 50% of the patients at diagnosis (1). Curative treatment options for BOT squamous cell carcinomas (SCCs) include definitive surgical resection alone, definitive surgical resection followed by postoperative radiation, definitive external beam radiation therapy (EBRT) with altered fractionation, EBRT with brachytherapy (BT) boost or concurrent chemoradiation (1–6). Local control rates are similar among these treatment modalities; however, toxicities due to treatment are different. Thus, the preferred management has become primary definitive radiation therapy with or without chemotherapy allowing for organ preservation and decreased functional morbidity.

In an effort to improve locoregional (LR) control while sparing normal tissues, EBRT followed by a boost dose, delivered with non-intensity-modulated radiation therapy (IMRT) external beam, IMRT, or BT boost have been pursued as strategies to locally escalate radiation doses. Such strategies have been shown to have similarly good outcomes in several single-institution studies (7–13). To date, there are no randomized trials comparing BT boost to EBRT boost. Only one retrospective study (14) has shown inferior 5-year actuarial local control with EBRT compared with those who received a BT boost (28% vs. 88%, $p < 0.0001$).

In this study, we analyzed the National Cancer Data Base (NCDB) to evaluate the patterns of care and impact of BT boost on overall survival (OS) for patients with SCC of the BOT.

Methods and materials

The NCDB is a hospital-based registry that is the joint project of the American Cancer Society and the Commission on Cancer of the American College of Surgeons. It is estimated that 70% of all diagnosed malignancies in the United States are captured by facilities participating in this registry and reported to the NCDB. The Commission on Cancer's NCDB and the hospitals participating in the NCDB are the source of the deidentified data used in this study. However, they have not been verified and are not responsible for the statistical validity or conclusions derived by the authors of this study. Exemption was obtained from the New York Harbor Veterans Affairs Committee for Research and Development before the initiation of this study.

We identified patients 75 years or younger, who were diagnosed with nonmetastatic SCC of the BOT between 2004 and 2012 who received either EBRT with chemotherapy or external beam radiation with chemotherapy along with a BT boost. We excluded those who had any surgery performed on the primary site. While the number of lymph nodes removed is identified by the NCDB, the presence of a neck dissection as opposed to an excisional biopsy is not independently coded within the NCDB. Therefore, we included those who had two or more neck nodes removed as having undergone a neck dissection. We excluded patients with a Charlson/Deyo score of two and also excluded those who survived ≤ 6 months from their diagnosis to account for immortal time bias.

Patient characteristics were compared between the groups using Pearson χ^2 , Fisher's Exact test, and Mann-Whitney tests where appropriate. Overall survival was analyzed by the Kaplan-Meier method and compared via the log-rank test. Univariable and multivariable logistic regression was performed to assess for predictors for brachytherapy usage. In addition, univariable and multivariable Cox regression was performed to assess the impact of different variables on overall survival. Variables with a p -value < 0.1 on univariable analysis were included in the multivariable model. The variables included in the logistic regression were age

(≤ 60 years, > 60 years), Charlson/Deyo score (0, 1), year of diagnosis (2004–2006, 2007–2009, 2010–2012), geographic location (Northeast, South, Midwest, West), gender (male, female), race (white, black, other), T-stage (T1, T2, T3, T4, unknown), N-stage (Nx-0, N1, N2-3), facility type (nonacademic, academic), and lymph nodes removed (0–1, ≥ 2). The Cox regression included these variables, with the addition of the treatment variable (external beam radiation, external beam radiation plus BT boost). All analyses were conducted using SPSS V 23.0 (IBM Inc, Armonk NY, USA). All tests were two sided, and a p -value < 0.05 was considered significant.

Results

Patient characteristics

We identified 15,934 patients who met the inclusion criteria. Only 137 (0.9%) patients received external beam radiation and brachytherapy boost (EBRT + BT) and the remaining 15,797 (99.1%) received EBRT only. The most common T-stage was T2 (37.9%, $n = 6039$) and the most common N-stage was N2-3 (67.8%, $n = 10,810$). BT boost was used 2.1% of the time in 2004 and consistently declined since that time to 0.2% in 2012 ($p < 0.001$). The use of IMRT increased in utilization from 22.8% in 2004 to 69.2% in 2012 ($p < 0.001$). BT boost was categorized as being low-dose-rate BT for 17 patients, high-dose-rate BT for 70 patients, and not otherwise specified for the remaining patients. For those who we identified as having a neck dissection, the median number of nodes removed was 21. Further details regarding patient characteristics and a comparison between those who did or did not receive a BT boost are available in Table 1.

Logistic regression

On univariable logistic regression, location of treatment outside the northeast was strongly associated with decreased BT use (OR 0.05–0.39), as well as more recent year of diagnosis (OR 0.21–0.55). The presence of a neck dissection, increasing T-stage, particularly T2 and T4, were associated with an increased likelihood of brachytherapy use, as well as race categorized as 'Other'. On multivariable logistic regression, there was a similar trend as observed from the univariable regression. Year of diagnosis 2007–2009 (OR 0.63, 95% CI 0.43–0.91, $p = 0.015$) and year of diagnosis 2010–2012 (OR 0.25, 95% CI 0.15–0.41, $p < 0.001$) were strongly associated with decreased BT use compared with 2004–2006. In addition, location of treatment in the South (OR 0.05, 95% CI 0.02–0.11, $p < 0.001$), Midwest (OR 0.11, 95% CI 0.06–0.18, $p < 0.001$), and West (OR 0.39, 95% CI 0.25–0.61, $p < 0.001$) were also strongly associated with a decreased likelihood of BT use compared with the Northeast. Neck dissection was strongly associated with an increased likelihood of BT use (OR 4.86, 95% CI 3.35–7.06, $p < 0.001$).

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