The American Journal of Surgery (2015) 210, 891-895

The American Journal of Surgery®

Clinical Science

Demographic risk factors impacting timely radiation therapy completion after breast conserving surgery

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KEYWORDS:
Breast cancer;
Breast conserving treatment;
Disparities

Abstract

BACKGROUND: Radiotherapy completion (RTC) is critical to successful breast conserving treatment. Our aim was to identify patient groups at greatest risk of not achieving timely radiotherapy completion (TRTC) in an urban setting.

METHODS: This observational cohort study used hospital registry data from 2004 to 2010 for female stage I and II breast conserving treatment patients to assess predictors of RTC and TRTC, defined as RTC of 35 to 49 days.

RESULTS: Two hundred sixty-one patients were analyzed. There was no difference in mean days to RTC by ethnicity (black 46.8, white 46.4, Hispanic 48.1 days, $P = .75$) or total RTC (black 88.2%, white 97.9%, Hispanic 93.3%, $P = .09$). However, a substantial difference was seen in TRTC by ethnicity (black 51.8%, white 79.2%, Hispanic 57.8%, $P = .03$). Multivariate logistic regression analysis of failure to achieve TRTC found associations with black race (odds ratio [OR] 2.67), Medicare (OR 3.46), Medicaid (OR 2.19), and age less than 50 years (OR 4.13).

CONCLUSIONS: This study demonstrates high overall percentage RTC but demonstrates disparities in TRTC. Those at greatest risk of unsuccessful TRTC were younger, Medicare or Medicaid insured, and black race.

It is estimated that nearly a quarter of a million individuals are diagnosed with breast cancer annually in the United States, and most will present with early-stage cancer.[1] The majority of these patients are treated with breast conserving treatment (BCT), consisting of breast conserving surgery followed by whole-breast radiation therapy.[2,3] Large-scale studies of patients with BCT have shown a reduction in disease recurrence, a reduction in breast cancer death, and a reduction in overall death with

There were no relevant financial relationships or any sources of support in the form of grants, equipment, or drugs.

The authors declare no conflicts of interest.

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Manuscript received September 26, 2014; revised manuscript April 1, 2015

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http://dx.doi.org/10.1016/j.amjsurg.2015.04.023

definitive adjuvant radiotherapy.[4,5] The corresponding challenge has been to ensure recommended receipt of radiotherapy for these patients as multiple studies have demonstrated suboptimal adherence to radiotherapy after breast conserving surgery.[6–10]

Disparities in receipt of postoperative radiotherapy have been documented for race, age, geography, insurance status, comorbid conditions, referral to an oncologist, and surgeon characteristics.[6,11,12] Despite the overall improving survival for women with breast cancer in the United States, survival rates for black women have not improved at the same rate as white women.[13] Additionally, studies have demonstrated that access to adjuvant therapy alone is insufficient to account for the persistent racial disparities in outcomes.[14–17]

Current breast cancer radiotherapy treatment guidelines recommend that patients receive approximately 5 weeks of adjuvant radiotherapy.[18] Previous studies have identified racial disparities in the receipt of guideline-recommended breast cancer treatment in early-stage breast cancer based on initiation or completion of radiation therapy.[6,15,19] Additionally, increased mortality has been demonstrated among patients with treatment interruptions of more than 7 days.[20] Unintended treatment interruptions result in additional days needed to achieve radiotherapy completion (RTC), resulting in a prolonged course as measured from start date to end date of radiotherapy. Relatively little is known regarding disparities in the timely completion of radiotherapy courses in breast cancer. The purpose of this study was to identify if disparities exist in achieving timely radiotherapy course completion for a racially and economically diverse patient cohort at an urban, academic medical center with a substantial underserved population.

Methods

This institutional review board-approved retrospective cohort study used data from the Temple University Hospital Cancer Registry, which is populated through chart abstraction and maintained by 3 certified tumor registrars. The Temple University Hospital Cancer Center is accredited by the Commission on Cancer of the American College of Surgeons. Cases from January 1, 2004 to December 31, 2010 were analyzed. Inclusion criteria were limited to female patients with American Joint Committee on Cancer 6th edition stage I or II breast cancer who underwent treatment with breast conserving surgery. Exclusion criteria consisted of male sex; patients with stage 0, III, or IV cancer; patients who were not Black, White, or Hispanic; patients with bilateral breast lesions; and patients who underwent total mastectomy or modified radical mastectomy.

Eight hundred nineteen patients were diagnosed with breast cancer from 2004 to 2010 at our institution. Patients with unknown stage (n = 45) and unknown date(s) of radiotherapy (n = 84) were excluded. Patients with in situ (n = 129), stage III (n = 72) or IV (n = 93) disease, and male patients (n = 3) were excluded. Patients who underwent mastectomy (n = 102) and those with incomplete treatment data (n = 30) were excluded. The result was a cohort of 261 patients. All patients had race data based on chart abstraction.

RTC was defined as having undergone a breast radiotherapy course, from date of start to date of end (including weekend days), of 35 days or more.[21] Timely radiotherapy completion (TRTC) was defined as finishing the radiotherapy course between 35 and 49 days, allowing an additional week from the typical 5- to 6-week course.[22] Failure to achieve TRTC was defined as a course of 50 or more days, 7 days or more in excess of the typical radiotherapy course.

Based on chart abstraction, race was defined as Black, White, or Hispanic. Insurance status was categorized as private, Medicare, or Medicaid. Proximity to the hospital was defined by patient zip codes that were located within versus beyond a 3-mile radius of the hospital. Thirteen of the 40 zip codes represented were within a 3-mile radius.

Statistical analysis of unadjusted associations for categorical variables was conducted with the chi-square test. For multivariable analysis of categorical variables, logistic regression was used. For ordinal variables, ordinal logistic regression models were used followed by a Brant test of parallel slopes. Interaction terms were assessed for independent variables including race, age, and distance, and none was significant. In cases where the assumption of parallel slopes was violated (age), the model was estimated using multinomial logistic regression. P values were 2 sided with $\alpha = .05$. Statistical analyses were performed using Stata statistical software (Stata13; Stata Corp, College Station, TX). Power calculation was performed using G*Power software to identify the required sample size appropriate to detect a difference at an odds ratio (OR) of 1.5 with a power of .80, which was 242 patients.

Results

The sample included 261 patients. Mean age of the sample was 60.7 years (range 30 to 90 years). The sample included 171 (65.5%) blacks, 49 (18.8%) whites, and 41 (15.7%) Hispanics. A majority (63.6%) of patients had stage I breast cancer, and 36.4% patients had stage II. Insurance status included Medicaid, with 100 (38.3%) patients, followed by private insurance for 95 (36.4%), and Medicare for 66 (25.3%). A majority (137, 52.5%) of patients lived within a 3-mile zip code radius of the hospital.

There were no overall differences by race in mean days of duration of radiotherapy treatment (black 46.8, white 46.4, Hispanic 48.1 days, $P < .75$) or percent completing treatment (black 88.2%, white 97.9%, Hispanic 93.3%, $P < .09$). However, a significant difference was seen in likelihood of TRTC by race (Table 1; black 52.6%, white 77.6%,