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BRACHYTHERAPY

Prostate brachytherapy utilization in the COVID-19 era: A cross-sectional study of radiation oncologists in the United States

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ABSTRACT

PURPOSE: Despite advantages such as abbreviated treatment course, brachytherapy (BT) utilization rates for prostate cancer (PC) in the United States (US) are declining. We surveyed practicing US radiation oncologists (ROs) to determine the proportion who offer BT for PC and whether the COVID-19 pandemic influenced practice patterns.

MATERIALS AND METHODS: From July-October 2021, we surveyed practicing US ROs. Provider demographic and practice characteristics were collected. Questions assessing utilization of BT and external beam (EBRT) for patients of varying risk groups and the effect of the pandemic on practice patterns were administered. Descriptive statistics were reported. The bivariate relationships between provider characteristics and likelihood of offering BT were assessed using the Chi-square test ($\alpha < 0.05$).

RESULTS: Six percent of surveyed ROs responded, with 203 meeting inclusion criteria (72% male, 72% white, 53% non-academic, 69% >10 years in practice) and 156 (77%) treating PC. For low-risk, fewer providers offered BT (41% total; 25% low dose rate [LDR], 10% high dose rate [HDR], 6% both) than stereotactic body (SBRT) (54%) and moderately hypofractionated radiation therapy (MHFRT) (83%). For favorable intermediate risk, fewer offered BT (37% total; 21% LDR, 10% HDR, 6% both) than SBRT (48%), MHFRT (87%), and conventionally fractionated EBRT (38%). For high (44%) and very-high (37%) risk, fewer offered EBRT+BT than EBRT alone. For every risk group, academic ROs were significantly more likely to offer BT (all p-values<0.05). <1% of respondents reported increased pandemic-related BT usage.

CONCLUSIONS: US ROs, particularly in non-academic settings, do not routinely offer BT monotherapy or boost (<50%). Practice patterns were unaffected by COVID-19. Retraining may be critical to increasing utilization.

Keywords: Brachytherapy; Cross-sectional study; Observational study; Prostate cancer; Practice patterns; Survey study

Introduction

Many patients with cancer report significant psychosocial and economic distress (1–3). Prostate cancer (PC) is the most common non-skin malignancy in male patients in the United States (US) (4). Because external beam radiation therapy (EBRT) is often delivered daily over the course of many consecutive weeks, the logistics of external beam radiation therapy (RT) can be particularly challenging (including securing reliable transportation and weathering extended time off work) (5,6). Brachytherapy (BT) is indicated as monotherapy for lower risk PC (7) or as a boost to EBRT for higher risk disease (8). BT has many benefits including decreased treatment time, the potential

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Abbreviations: abs, American brachytherapy society; hfrt, hypofractionated radiation therapy; mhfrt, moderately hypofractionated radiation therapy; REDCap, research electronic data capture.

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for lower costs (9,10), and improved biochemical progression free survival (bPFS) as a boost in patients with higher risk disease (8).

Despite these advantages, utilization rates in the US are declining (11). Prior work revealed that provider demographic and practice characteristics play a substantial role in the variable utilization of other forms of shortened RT courses, such as hypofractionated EBRT (HFRT) (12,13). However, these attitudes have not been characterized for BT in the US. Thus, we surveyed practicing radiation oncologists (ROs) in the US to gain insight into the perceptions impacting utilization of BT in this country. We also assessed whether the COVID-19 pandemic influenced practice patterns, as it may have provided additional impetus for implementation of shorter regimens to minimize exposures to the healthcare setting (14,15). We hypothesized that the proportion of providers offering BT would continue to lag EBRT.

Material and Methods

From July to October 2021, an anonymized, online survey was distributed to ROs registered within an online database. ROs specializing in treating GU malignancies and providers with more general practices were eligible for inclusion. Non-ROs (e.g., advanced practice providers), ROs currently in residency or fellowship training, retirees, and ROs practicing in other countries were excluded. Demographic and practice characteristics were collected from ROs including, but not limited to, years in practice after training, gender, race, ethnicity, region of practice, academic versus non-academic setting, annual patient volume, rural versus urban patient population, and whether respondents treated PC. For low risk to very high-risk disease, ROs treating PC were asked about their utilization of low dose rate BT (LDR-BT), high dose rate BT (HDR-BT), stereotactic body radiation therapy (SBRT), moderately HFRT (MHFRT), conventionally fractionated EBRT (CFEBRT), and EBRT plus BT boost. Questions were written in such a way as to capture whether respondents would offer BT to patients of varying risk group but not necessarily whether they would perform the procedure themselves (e.g., they may refer patients to a colleague for BT). The effect of the COVID-19 pandemic on practice patterns (e.g., increased utilization of BT) was also assessed.

Study data were collected and managed using REDCap (Research Electronic Data Capture) electronic data capture tools hosted at our institution; (16,17) REDCap is a secure, web-based software platform designed to support data capture for research studies, providing (*1*) an intuitive interface for validated data capture; (*2*) audit trails for tracking data manipulation and export procedures; (*3*) automated export procedures for seamless data downloads to common statistical packages; and (*4*) procedures for data integration and interoperability with external sources.

Table 1
Detailed characteristics of survey respondents

Provider characteristic	N (%)
Total	203 (100)
Gender ($n=200$)	
Male	146 (72%)
Female	54 (27%)
Race	
White	146 (72%)
Asian	42 (21%)
Black/African American	3 (1%)
Other	12 (6%)
Ethnicity	
Non-Hispanic	195 (96%)
Hispanic	8 (4%)
Practice type ($n=194$)	
Academic	86 (42%)
Non-academic	108 (53%)
Years in practice	
0–5	37 (18%)
6–10	25 (12%)
11–20	61 (30%)
>20	80 (39%)
Patients per year ($n=202$)	
Median (IQR)	250 (175–300)
Range	15–3600
Region of practice ($n=195$)	
Northeast	50 (25%)
Southeast	43 (21%)
Midwest	58 (29%)
West	44 (22%)
Practice setting	
Mostly urban	66 (33%)
Mostly rural	40 (20%)
Mix	97 (48%)
Proportion of minority patients	
<10%	58 (29%)
10–29%	85 (42%)
30–50%	40 (20%)
>50%	20 (10%)
Treat prostate cancer	
Yes	156 (77%)
No	47 (23%)

Descriptive statistics, including frequency counts and proportions for categorical variables and medians with ranges and interquartile ranges for continuous variables, were reported. The bivariate relationships between provider characteristics and likelihood of offering BT were assessed using the Chi-square test. Analysis was performed using SAS v9.4 (SAS Institute; Cary, NC; www.sas.com). Statistical significance was defined as two-sided alpha < 0.05. This study was reviewed and approved by the appropriate institutional review board and informed consent was obtained from all participants.

Results

Of the 5432 ROs that received the survey, 327 (6%) completed the questionnaire. After excluding ineligible respondents practicing outside the US, 203 respondents met

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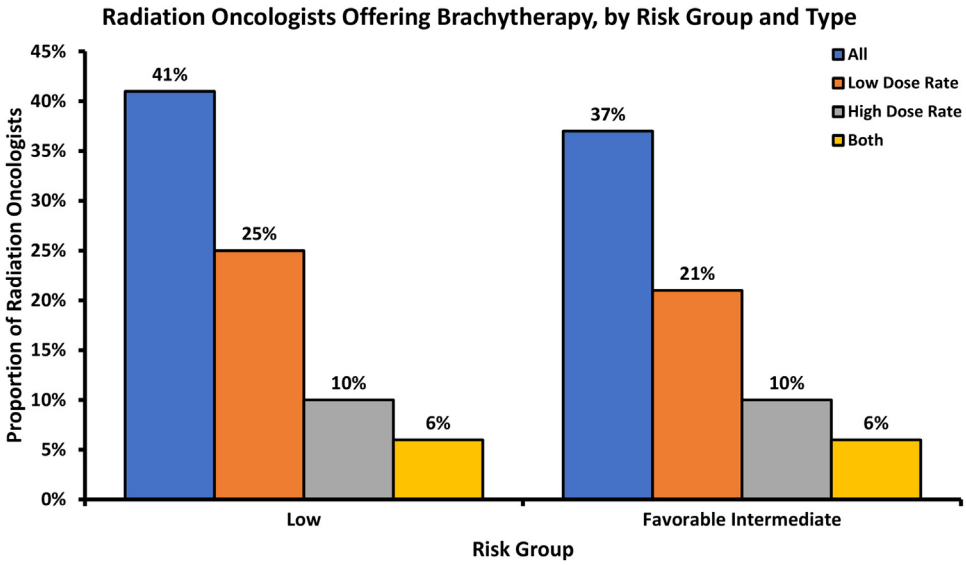

Fig. 1. Proportion of radiation oncologists offering brachytherapy monotherapy for low and favorable intermediate risk disease.

Table 2
Bivariate relationships between provider characteristics and likelihood of offering brachytherapy for prostate cancer of varying risk group.

	Practice type			Years of practice			Practice setting				Minority population		
Risk group	academic	Non-Academic	*p*	0–10	10+	*p*	Rural	Urban	Mix	*p*	<30%	≥30%	*p*
Low	54%	36%	**0.037**	34%	46%	0.161	49%	48%	36%	0.319	45%	38%	0.406
Favorable intermediate	60%	34%	**0.003**	39%	45%	0.495	51%	52%	32%	**0.045**	45%	38%	0.406
Unfavorable intermediate	56%	30%	**0.002**	32%	42%	0.243	33%	48%	36%	0.309	41%	36%	0.563
High	58%	35%	**0.008**	26%	46%	0.254	38%	46%	45%	0.754	45%	40%	0.565
Very high	50%	29%	**0.012**	34%	38%	0.691	28%	38%	41%	0.433	37%	36%	0.871

eligibility criteria, of which 156 (77%) reported treating PC (Supplemental Figure 1). Respondents were predominately male (72%), white/Asian (93%), practicing outside of academics (53%) with a mix of partially urban and rural patient population (48%), and more than 10 years out from training (69%) (Table 1). Respondents were equally distributed by geographic region and reported a wide range in practice volume with a median of 250 patients per year (interquartile range 175–300).

Overall, fewer providers offered LDR-BT than HDR-BT for all the risks groups (Fig. 1). For low-risk disease, fewer ROs offered BT (41% total; 25% LDR, 10% HDR, 6% both) than SBRT (54%) or MHFRT (83%) but even fewer offered CFEBRT (37%). For favorable intermediate disease, fewer providers offered BT (37% total; 21% LDR, 10% HDR, 6% both) than SBRT (48%), MHFRT (87%), and CFEBRT (39%). For unfavorable intermediate disease, fewer ROs offered BT alone (7%) and BT+EBRT (37%) than MHFRT (82%) and CFEBRT (46%). For high-risk disease, fewer providers offered EBRT+BT (44%) than MHFRT (66%) or CFEBRT (55%). For very high-risk disease, fewer ROs offered EBRT+BT (37%) than MHFRT (61%) or CFEBRT (58%).

For every risk group, academic ROs were significantly more likely to offer BT monotherapy or boost than non-academic ROs (Table 2, all p-values < 0.05). For each risk group, 50–60% of academic ROs offered BT versus 29–36% of non-academic ROs (Fig. 2). For favorable intermediate PC only, ROs treating a mix of both urban and rural patients were significantly less likely to offer BT than those practicing in just mostly urban or rural settings ($p = 0.045$). Otherwise, no additional provider characteristics were significantly associated with offering BT for any PC risk group. Less than 1% of respondents reported increased prostate BT usage due to the pandemic.

Discussion

The potential benefits of BT include decreased costs, shorter duration of therapy, and improved bPFS (8–10). Yet, BT remains underutilized by providers as demonstrated by our analysis. This finding is consistent with data from the National Cancer Database showing that BT utilization rates in the US are declining at both academic and non-academic centers, while use of intensity modulated radiation therapy has increased (11). Thus, it is unsurprising that reported rates of offering BT in our surveyed population would lag EBRT options of varying course length, including even SBRT which can require extensive resources or expertise to implement. Provider comfort with BT is

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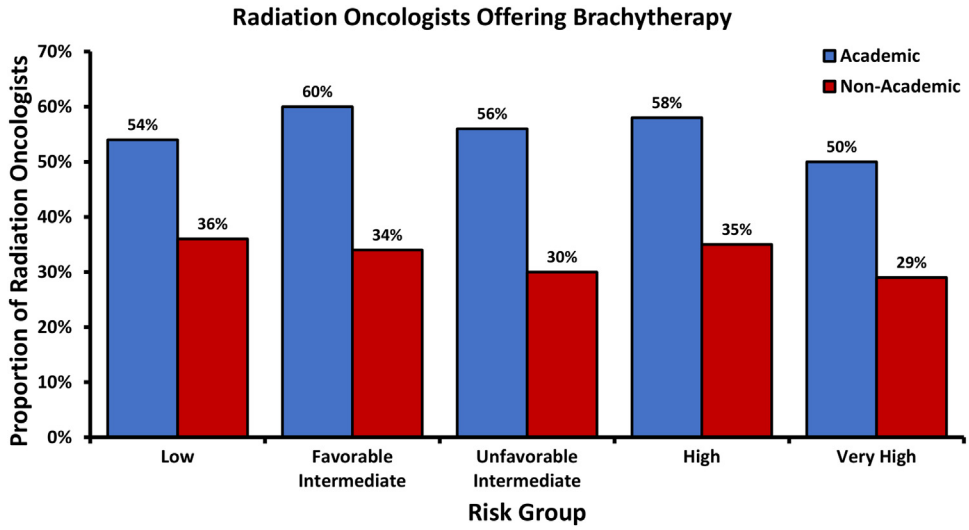

Fig. 2. Proportion of academic versus non-academic radiation oncologists offering brachytherapy monotherapy or boost, by risk group (all p-values $<$ 0.05).

likely a concern, but opportunities for additional training exist through professional organizations like the American Brachytherapy Society (ABS).

Expanding BT usage is important, because it is an avenue to meaningfully address persistent concerns in this patient population such as extended treatment time with EBRT (CFEBRT can last upwards of 8 weeks). Fewer trips for treatment results in fewer missed workdays and increased convenience for patients, particularly those residing in rural areas far away from treatment facilities. Hypofractionated treatments were preferred during the COVID pandemic; (14,15) however, we found that BT practice patterns were largely unaffected with less than 1% of surveyed ROs reporting increased use of BT due to COVID. This finding is not unexpected given the additional physician and staff training required to launch a BT program. Additionally, operating room accessibility may have been an issue.

While the relationship between provider characteristics and likelihood of offering BT has been poorly studied in the US, prior studies have shown that provider characteristics play an important role in utilization of shorter treatment regimens such as HFRT (12,13). For example, a recent international survey study noted that ROs who specialized in breast cancer (dedicating greater than 50% of clinical time to that site) were more likely to offer MHFRT (12). Assuming that those in academic practice are more likely to specialize, we found a similar finding with academic ROs more likely to offer BT for every risk group. Thus, inexperience may be a barrier to offering BT. Through a multi-phased, comprehensive approach, the 300 in 10 initiative by the ABS aims to greatly expand the pool of competent brachytherapists by addressing low BT volume in some residency training programs and other critical deficits in the current RO ecosystem (18). Thus, skills retraining for practicing ROs is one potential opportunity to increase utilization rates. For favorable intermediate PC only, ROs treating a mix of both urban and rural patients were significantly less likely to offer BT than those practicing in just mostly urban or mostly rural settings. Given that this finding was only marginally significant and was not replicated across other risk groups, it may be attributable to chance.

Another barrier to offering BT, particularly in rural areas, may be low patient volume rendering maintaining a BT program (e.g., source replacement for HDR techniques) prohibitively expensive. In this scenario, efforts should be made to ensure a close relationship with institutions that are able to offer BT, particularly for patients with higher risk disease who would benefit from BT boost (8). However, the feasibility of multi-institution partnerships where EBRT is delivered at one site and BT boost at the other will be tested by impending payment reform towards fixed, per episode reimbursement (19). Toxicity concerns, particularly urinary, may be another possible explanation for low rates of offering BT boost for higher risk disease, particularly in the non-academic setting. However, the potential decrease in urinary toxicity with omission of BT in these patients must be weighed carefully against the improved bPFS offered by BT boost (8,20). Similarly, concern for urinary toxicity may also influence the likelihood of offering BT monotherapy. However, the potential for increased urinary toxicity with BT alone must be balanced against decreased risk of secondary malignancy, erectile dysfunction, and gastrointestinal toxicity with respect to EBRT (20).

Limitations of this analysis result from the imperfections of survey research. For example, it is possible that the ROs who responded to our survey were not representative of the practicing population, as the response rate was

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6%. However, the demographics of our cohort appear to be fairly representative of the practicing population (21,22). Additionally, our respondents were well distributed regionally with a mix of urban and rural practice settings and annual patient volumes.

Conclusions

In summary, BT utilization is inconsistent among US ROs that treat PC despite its cost and logistical advantages for patients. Surprisingly, the COVID-19 pandemic only minimally affected practice patterns. Hesitancy to offer BT appears related to provider characteristics such as non-academic practice setting. Skills retraining like the ABS 300 in 10 initiative (18) may be an avenue to increase utilization rates. Whether impending payment reform de-emphasizing fee for service will influence practice patterns is an area for future study.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.brachy.2022.08.016.

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