ELSEVIER

Brachytherapy ■ (2016) ■

BRACHYTHERAPY

Cervical cancer brachytherapy in Canada: A focus on interstitial brachytherapy utilization

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ABSTRACT

PURPOSE: Brachytherapy (BT) techniques for cervical cancer in Canada have changed over the last decade, with evolution to high-dose-rate and image-guided BT. However, there are currently no national data on the use of interstitial BT (IBT). The purpose of this study was to document IBT utilization in Canadian centers, as well as update details of cervical cancer BT practices.

METHODS AND MATERIALS: All Canadian centers with gynecologic BT services (n = 33) were identified, and one gynecology radiation oncologist per center was sent a 33-item e-mail questionnaire regarding their center's practice for cervical cancer BT in 2015. Responses were reported and compared with practice patterns identified in a 2012 Canadian survey.

RESULTS: The response rate was 85% (28/33 centers). The majority (93%) of respondents used high-dose-rate BT, similar to the 2012 survey; 96% of centers had transitioned to three-dimensional (MRI/CT)−based planning in 2015 vs. 75% in 2012 (p = 0.03); 57% centers incorporated MRI for treatment planning in 2015 compared to 38% in 2012 (p = 0.15); the majority (13/16) using a combination of MRI and CT; 50% (14/28 centers) had the capacity to perform IBT, whereas 71% of those that did not referred patients to other centers. Of centers performing IBT, the majority (11/14) used template-based techniques with a median of 6 (range 2−20) needles/catheters and an average of 4 (range 1−5) fractions. Catheters were placed using: strategy based on pre-op imaging (21%), intra-op ultrasound (50%), intra-op MRI (7%), and intra-op CT (21%). The most common dose/fractionation schedules were 6 Gy × 5 fractions (40%), 8 Gy × 3 fractions (19%), and 7 Gy × 4 fractions (15%).

CONCLUSIONS: In Canada, treatment of cervical cancer continues to evolve. IBT has been adopted by half of the responding centers. As more centers move to MRI-based image-guided treatment planning, IBT will become an even more integral part of cervical cancer treatment.

Keywords: Cervical cancer; Interstitial brachytherapy; Utilization; Practice pattern

Introduction

Brachytherapy (BT) is an essential component of cervical cancer treatment. A surveillance, epidemiology and end results database report found that the cause-specific survival and overall survival were higher for women whose treatment included BT compared to matched cohorts who did not (1).

Cervical cancer BT practice in Canada has rapidly changed over the last decade. Three-dimensional (3D) image-guided BT (IGBT) has been widely adopted after the publication of the joint American Brachytherapy Society (ABS) and Groupe Européen de Curiethérapie and the European Society for Radiotherapy & Oncology (GEC-ESTRO) recommendations (2−4). MRI-based planning for at least part of the BT treatment has become common. High dose rate (HDR) had largely replaced low-dose-rate BT. These changes were documented in previous patterns-of-practice surveys from Canada (5, 6) and the United States (7−9). The use of interstitial BT (IBT) for cervical cancer in Canadian practice has not been assessed.

IGBT improves dose delivery in cervical cancer and improves sparing of organs at risk (10). In 2012, ABS issued

Received 28 August 2016; received in revised form 17 October 2016; accepted 31 October 2016.

Financial disclosure: None.

Conflicts of interest: None.

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1538-4721/$ - see front matter
http://dx.doi.org/10.1016/j.brachy.2016.10.009

guidelines recommending the use of interstitial needles for cervical cancer (11). The GEC-ESTRO also published similar recommendations and numerous reports on use of interstitial needles (12, 13).

There are currently no national data on the use of IBT in the management of patients with cervical cancer. The purpose of this survey was to document IBT utilization in Canadian centers, as well as to update details of cervical cancer BT practices. The hypothesis was that the majority of Canadian cancer centers have adopted IBT for cervical cancer.

Methods and materials

All Canadian cancer centers with gynecologic BT services ($n = 33$) were identified from the website of Canadian Association of Radiation Oncology (www.caro-acro.org), personal communication with the Canadian Brachytherapy Group president, and individual phone calls. A 33-item questionnaire, designed using SurveyMonkey (www.surveymonkey.com Palo Alto, CA) was sent to one representative radiation oncologist per center who performed BT for gynecologic cancers. A reminder e-mail was sent 2 weeks later to all invitees if they had not responded.

Questions were focused on radical, curative-intent treatment of the intact cervix using external beam radiotherapy and BT. Results were tabulated and compared to 2012 survey using SurveyMonkey and Microsoft (Seattle, WA) Excel software. Responses were compared using chi-square proportional analysis and p-values reported where appropriate. Results were analyzed in aggregate, although the respondents were not anonymized. All data were collected in accordance with the Health Information Act of Alberta after ethical review using the Alberta Research Ethics Community Consensus Initiative method (14).

Results

The survey was conducted between December 2015 and January 2016. Twenty-eight out of 33 invitees completed the survey (response rate 85%). Twenty-seven out of 28 centers were using HDR and one center used pulsed-dose-rate BT.

Imaging modality for insertion, volume delineation, and planning

Fourteen of 28 (50%) centers were using in-suite imaging for BT compared to 10 of 24 (42%) centers in 2012 ($p = 0.40$). The number of centers moving patients to a diagnostic imaging department for imaging was similar, 7/28 (25%) in 2015 vs. 7/24 (29%) in 2012. Two centers had a dedicated magnetic resonance imaging unit within the BT suite in 2015, compared to none in 2012.

Twenty-one (75%) centers used ultrasound (US) as image guidance for insertion of the BT applicators. Most centers used a transpelvic/abdominal technique; two centers (7%) used a transrectal US. The proportion of centers that were using 3D planning increased to 96% (27/28) in 2015 compared to 75% (18/24) in 2012 ($p = 0.03$), and the number of centers utilizing two-dimensional imaging (x-rays/orthogonal films) for planning decreased (1/28 centers) Fig. 1. The number of centers that obtain MRI for at least the first fraction, with applicator in place, for treatment planning continues to increase; 57% (16/28) in 2015 compared to 38% (9/24) in 2012 ($p = 0.15$). Four out of 16 centers that used MRI for volume delineation used it for all the fractions, whereas all centers (16/16) used it for at least the first insertion and the remainder of the fractions were delivered using CT guidance. The number of centers that contoured high-risk clinical target volume (HR CTV) increased from 15/24 (63%) in 2012 to 21/28 (75%) in 2015 ($p = 0.33$).

Interstitial BT

Table 1 summarizes the use of IBT in Canada in 2015. Fourteen of 28 responding centers had the ability to treat patients with cervical cancer with IBT. Ten out of 14 (71%) centers that did not have the ability to perform IBT referred their patients to other centers, if deemed eligible for IBT by the treating physician. Although the data presented are in aggregate form, examination of individual responses revealed that majority of the centers performing IBT were larger centers directly affiliated with academic institutions. The ability to perform IBT in a center was related to MRI-based planning capability; 10 of the 14 (71%) IBT-capable centers also used MRI-based planning; 50% (7/14) of respondents with IBT at their center used it for more than 25% of patients. Eleven (79%) respondents performing IBT determined its utility based on disease extent at the time of BT as well as imaging studies performed at the time of diagnosis and just before BT.

In terms of IBT technique, 9 of 14 (64%) respondents performing IBT used a free-hand, template-based technique only, whereas two (14%) centers the have capability of

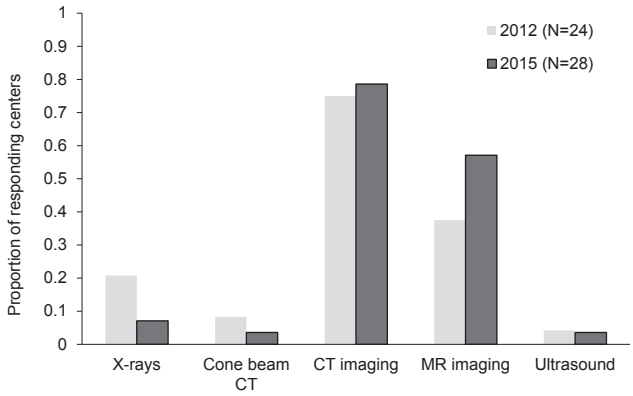

Fig. 1. Imaging used for cervix cancer brachytherapy planning in 2012 ($n = 24$) and 2015 ($n = 28$) across Canada.