Cervix cancer brachytherapy

Brachytherapy for carcinoma of the cervix: A Canadian survey of practice patterns in a changing era

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ABSTRACT

Background and purpose: This survey aimed to document practices of Canadian radiation oncologists performing gynecologic brachytherapy for carcinoma of the cervix and to determine what the effect of the phasing-out of LDR after-loading systems from the commercial market is having on practice.

Materials and methods: A 26-item questionnaire was developed to survey various aspects of brachytherapy practice to include: number of patients treated, prescription points/volume, dose and fractionation, timing, critical structure delineation, expected changes due to the phasing-out of support for low dose rate systems, and support for the development of national guidelines. A link to a web-based survey collection instrument was emailed to each radiation oncologist in Canada practicing gynecologic brachytherapy.

Results: A 67% response rate was achieved in this web-based survey. Radiation oncologists currently using HDR brachytherapy are most commonly delivering 5 fractions of 6 Gy in addition to an EBRT dose of 45 Gy in 25 fractions. The median total dose equivalents to Point A was 82.9 Gy for both early and advanced disease. In response to the announcement by a major vendor that they would be phasing-out service for a popular LDR after-loader, 49% of Canadian radiation oncologists who practice brachytherapy for cervix cancer are changing to an HDR technique with a further 9% changing to a PDR technique. Eighty-six percent of respondents would support the development of national guidelines for cervix brachytherapy in Canada.

Conclusions: Variation in practice exists in Canada in brachytherapy for cervix cancer. Many centers are in the process of phasing-out LDR techniques in response to the withdrawal of commercial support for these systems. Support for the development of Canadian national guidelines is high.

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Low dose rate (LDR) intracavitary treatments have previously been considered to be the standard brachytherapy boost delivered in combination with external beam radiotherapy for carcinoma of the cervix. High dose rate (HDR) brachytherapy techniques emerged in the 1950s, and have been adopted by many centers [1]. A major manufacturer of brachytherapy applicators and after-loaders announced recently that they would no longer guarantee service for their LDR after-loaders after December 31, 2009. This has forced institutions utilizing this equipment either to maintain this equipment in-house accepting a level of medico-legal risk, or to change to an HDR or pulsed dose rate (PDR) system, which is becoming readily available and supported in the commercial market.

Previous studies have examined brachytherapy usage in Europe [2,3], the United States [4–8] and Japan [9]. However, we were unable to identify any previously published practice pattern study for brachytherapy for carcinoma of the cervix that specifically surveyed Canadian centers. We were interested in determining not only what the current practice is in Canadian centers but how the phasing-out of low dose rate technology from the commercial brachytherapy market is changing practice.

Materials and methods

Canadian radiation oncologists treating gynecologic malignancies were identified from the official website of the Canadian Association of Radiation Oncology [10], from individual cancer center directories, and by telephone queries to individual cancer centers. It was correspondingly possible to identify all 57 radiation oncologists in Canada who practice gynecologic brachytherapy.

A 26-item questionnaire was developed to survey various aspects of brachytherapy practice including: number of patients treated, types of after-loaders used, radioisotopes used, applicators used, treatment planning system used, imaging modality used for planning, dose points recorded, bladder dose determination, maximum permitted bladder dose, rectal dose determination, maximum permitted rectal dose, external beam radiotherapy (EBRT)
For LDR brachytherapy, the most commonly reported brachytherapy dose per fraction, number of brachytherapy fractions, total brachytherapy dose to Point A, effect of withdrawal of support for LDR after-loaders, and support for the development of national guidelines. All questions pertained to primary radiotherapy for patients with carcinoma of the cervix treated with curative intent. The survey was prepared in both Canadian official languages (English and French).

A link to the survey was circulated to all 57 Canadian radiation oncologists via an email link to an electronic survey collection instrument [11]. Non-responders were contacted by two repeat emails and/or by telephone. Responses were tabulated and analyzed, but statistical analysis was not performed due to the limited sample size.

Results

Thirty-eight of the 57 radiation oncologists polled replied to this survey, for a 67% response rate. The estimated number of patients treated in 2005 by each respondent is shown in Fig. 1. The median number of cervical cancer patients, per radiation oncologist was 10–20 patients.

Technology

The majority of respondents (66%) most commonly utilize a Fletcher-type (tandem and ovoids) applicator, while 22% utilize a tandem and ring applicator. A minority of respondents most commonly use a tandem alone (9%) or the Henschke applicator (3%). The most frequently used planning system was Nucletron’s PLATO (41%), with Varian’s ‘Brachyvision’ used by 38% of respondents. Less commonly used planning systems included Nucletron’s “NPS”, and “in-house” systems.

Radiation dose and fractionation

The majority of radiation oncologists record “Point A” as well as bladder and rectal points (Fig. 2). Ninety-one percent of respondents utilize the ICRU-38 definition [12] to define their bladder point, while 9% utilize computed tomography (CT) to define the bladder dose. Similarly, the majority of respondents defined the rectal point utilizing the ICRU definition or a rectal catheter with only 9% utilizing CT. For early stage disease, defined as stage Ib to IIa, 78% of respondents use an external beam radiotherapy dose of 45 Gy in 25 fractions. For advanced stage disease, defined as IIb to III, 44% of respondents prescribe 45 Gy in 25 fractions with 25% prescribing 50 Gy in 25 fractions. The majority of respondents (77%) initiate brachytherapy between the 4th week of EBRT and “as soon as possible” following EBRT. For LDR brachytherapy, the most commonly reported brachytherapy dose for those performing single insertions was 35 to <40 Gy for both early and late stage disease (67% and 50%, respectively). For those performing multiple LDR treatments, the most common brachytherapy dose was 24–30 Gy in two insertions for both early and late stage disease (43% and 54%, respectively).

For both early and late stage disease, the most frequently reported HDR and EBRT dose and fractionation schedule was 6 Gy times 5 fractions following 45 Gy in 25 fractions of EBRT (Table 1). For early stage disease, a minority of respondents reported using 46 Gy in 23 fractions (5%) or 40 Gy in 20 fractions (5%) for the EBRT component of therapy. For late stage disease, a minority of respondents used 50 Gy in 25 fractions EBRT with the following HDR brachytherapy regimens: 6 Gy times 5 fractions (21%), 7 Gy times 3 fractions (5%), and 8 Gy times 3 fractions (5%). Using the linear–quadratic model as recommended by Nag et al., we calculated the range of total dose equivalents to Point A used by respondents for early and late stage disease [13]. The total dose equivalents (2 Gy) to Point A ranged from 69.5 to 98.9 Gy (median 82.9 Gy) for early stage disease and from 67.3 to 104.7 Gy (median 82.9 Gy) for late stage disease. The crude total dose to Point A was a median of 72.5 Gy. For those respondents using PDR, all respondents are using 35–40 Gy to Point A in a single insertion.

For brachytherapy planning, the median maximum dose to the rectum accepted was 75% of the prescribed dose; for the bladder, the median was 80% of the prescribed dose.
While 77% of respondents are performing treatment planning and dosimetry with each fraction, 9% are planning only the first insertion and 11% are using “standard plans”. When asked how their brachytherapy planning is performed, 85% responded that they were using orthogonal X-ray films with 15% using CT-based planning.

**Effect of withdrawal of LDR support on practice**

Respondents were specifically asked how they were changing their practice following an announcement that support for a popular LDR after-loader was being discontinued. Forty-nine percent of radiation oncologists reported that this announcement has been the cause of their decision to change to an HDR brachytherapy technique. Nine percent of respondents replied that they intended to change to a PDR system while 3% were undecided. Eighty-six percent of respondents were already using HDR or PDR and will continue to do so.

In response to the question “Would you support the development of national guidelines for cervical brachytherapy”, 86% responded in the affirmative.

**Discussion**

This study represents the first survey of Canadian practice for brachytherapy for cancer of the cervix. The survey was conducted as a means of documenting national practice at a time when cervical cancer brachytherapy methods are in a state of flux. The withdrawal of technical support for a popular LDR brachytherapy unit has created a situation in which there is no longer a commercially supported LDR after-loading system for brachytherapy. This has prompted significant change in gynecologic brachytherapy in Canada with more than half of respondents indicating that this announcement had prompted them to change to either an HDR technique or to a PDR technique.

Only 22% of Canadian radiation oncologists who perform brachytherapy implants for cervical cancer treat fewer than 10 patients per year. This is in contrast to the Eifel pattern of practice study which showed that at 27% of surveyed American facilities were treating fewer than 2 patients per year [5]. Similarly, Nag et al. found that the median number of patients treated by American physicians was 6 with 25% treating fewer than 4 patients [7]. It has been shown that patients treated at cancer centers with low patient volumes are more likely to be treated with EBRT alone, receive a relatively low total radiation dose, and are more likely to have a protracted course of treatment [5]. The American Brachytherapy Society has suggested that radiation oncologists with low case loads may need to be referring to major medical centers with established brachytherapy expertise [7]. The delivery of radiotherapy services in Canada is centralized, with radiation oncologists treating a relatively higher number of patients per year.

The total crude dose to Point A in our study was 72.5 Gy for both early and advanced disease. This compares to the Gynecologic Cancer Intergroup which reported a crude sum of 79.2 Gy to Point A, and the American Brachytherapy Society survey of practice in the United States which reported a median crude dose to Point A of 77 Gy for early and 80 Gy for advanced disease [3,7]. Similarly, the review by Montana et al. of the 1978, 1983 and 1988–1989 patterns of care survey in the United States reported a mean crude paracentral dose of 79.96 Gy in 1983 and 79.80 Gy in 1988–1989 [8]. It is important to note that these studies did not convert the crude doses into biologically equivalent doses correcting for different fraction sizes. There are significant challenges reporting and comparing doses for intracavitary brachytherapy within the literature because of the different doses and fractionation schedules used. It is more meaningful and relevant for direct comparisons to report biologically equivalent doses normalized to 2 Gy per fraction or a calculated dose with a specific α/β value. In this Canadian survey, the total Point A dose using the linear–quadratic model [13] for patients receiving EBRT and HDR brachytherapy was a median of 82.9 Gy for both early and advanced disease (normalized to 2 Gy/fraction and α/β = 10). Erickson’s 1996–1999 American pattern of practice study reported a median dose of 85.8 Gy when correcting Point A dose with the extrapolated response dose mathematical model which is also based on the linear–quadratic model and an α/β of 10 [4]. Toita’s Japanese pattern of practice study reported lower doses to Point A in Japan of a median of 74 Gy, which is only 61.7 Gy when corrected using the linear–quadratic model and a standard dose of 2 Gy per fraction [9].

Eighty-six percent and 89% of Canadian radiation oncologists are performing bladder and rectal point calculations, respectively, for each insertion. This high rate is similar to American and European pattern of care studies, which report that bladder and rectal point calculations are being done for greater than 75% of insertions [3,7,8]. The Japanese Group report a lower rate of bladder and rectal point calculations at less than 25% of insertions [9]. We did find that 9% of Canadian radiation oncologists are only planning the first insertion, and a further 11% are using “standard plans” despite the evidence that individualized treatment planning with each insertion results in decreased dose to critical structures [14,15].

Canada is a significant contributor to international cancer clinical trials; however, Canadian cervical cancer brachytherapy practice has not previously been documented. Limitations of this study are that it is a retrospective survey, and is not a formal audit of radiotherapy actually delivered. With a response rate of 67%, however, this survey does represent the practice pattern of the majority of Canadian radiation oncologists who perform brachytherapy implants for cervix cancer.

**References**