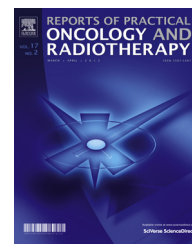


Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

ScienceDirect

journal homepage: <http://www.elsevier.com/locate/rpor>

## Original research article

# Should we customize PTV expansions for BMI? Daily cone beam computerized tomography to assess organ motion in postoperative endometrial and cervical cancer patients



Arya Amini<sup>a</sup>, Peter E. DeWitt<sup>b</sup>, Yevgeniy Vinogradskiy<sup>a</sup>,  
Chad G. Rusthoven<sup>a</sup>, Cem Altunbas<sup>a</sup>, Tracey E. Schefter<sup>a</sup>,  
Christine M. Fisher<sup>a,\*</sup>

<sup>a</sup> Department of Radiation Oncology, University of Colorado School of Medicine, Aurora, CO, United States

<sup>b</sup> Department of Biostatistics and Informatics, University of Colorado Denver, Aurora, CO, United States

## ARTICLE INFO

## Article history:

Received 29 July 2015

Received in revised form

4 November 2015

Accepted 7 February 2016

Available online 2 March 2016

## Keywords:

BMI

Postoperative pelvic radiation

IMRT

IGRT

Organ motion

## ABSTRACT

**Aim:** A single-institution review assessing patient characteristics contributing to daily organ motion in postoperative endometrial and cervical cancer patients treated with intensity-modulated radiotherapy (IMRT).

**Background:** The Radiation Therapy Oncology Group has established consensus guidelines for postoperative pelvic IMRT, recommending a 7 mm margin on all three axes of the target volume.

**Materials and methods:** Daily shifts on 457 radiation setups for 18 patients were recorded in the x axis (lateral), y axis (superior–inferior) and z axis (anterior–posterior); daily positions of the planning tumor volume were referenced with the initial planning scan to quantify variations.

**Results:** Of the 457 sessions, 85 (18.6%) had plan shifts of at least 7 mm in one of the three dimensions. For obese patients (body mass index [BMI]  $\geq 30$ ), 75/306 (24.5%) sessions had plan shifts  $\geq 7$  mm. Odds of having a shift  $\geq 7$  mm in any direction was greater for obese patients under both univariate (OR 4.227, 95% CI 1.235–14.466,  $p=0.021$ ) and multivariate (OR 5.000, 95% CI 1.341–18.646,  $p=0.016$ ) analyses (MVA). Under MVA, having a BMI  $\geq 30$  was associated with increased odds of shifts in the anterior–posterior (1.173 mm, 95% CI 0.281–2.065,  $p=0.001$ ) and lateral (2.074 mm, 95% CI 1.284–2.864,  $p<0.000$ ) directions but not in the superior–inferior axis (0.298 mm, 95% CI  $-0.880$  to 1.475,  $p=0.619$ ) exceeding 7 mm.

**Conclusions:** Based on these findings, the standard planned tumor volume expansion of 7 mm is less likely to account for daily treatment changes in obese patients.

© 2016 Greater Poland Cancer Centre. Published by Elsevier Sp. z o.o. All rights reserved.

\* Corresponding author at: Department of Radiation Oncology, University of Colorado School of Medicine, 1665 Aurora Court, Room 1032, Aurora, CO 80045, United States. Tel.: +1 720 848 0705; fax: +1 720 848 0222.

E-mail addresses: [arya.amini@ucdenver.edu](mailto:arya.amini@ucdenver.edu) (A. Amini), [Christine.fisher@ucdenver.edu](mailto:Christine.fisher@ucdenver.edu) (C.M. Fisher).  
<http://dx.doi.org/10.1016/j.rpor.2016.02.003>

1507-1367/© 2016 Greater Poland Cancer Centre. Published by Elsevier Sp. z o.o. All rights reserved.

---

## 1. Background

Over two-thirds of the United States population is currently overweight or obese with the trend continuing to increase.<sup>1</sup> Obesity is known to contribute to increasing rates of commonly occurring cancers including endometrial, where approximately 50–90% of all cases in the United States are attributable to obesity.<sup>2,3</sup> The World Cancer Research Fund published data concluding endometrial cancer to have the highest relative risk (RR=3.40) of development from obesity with 49% of U.S. diagnoses being preventable.<sup>4</sup> Both premenopausal and postmenopausal obese women have been found to have higher rates of endometrial cancer.<sup>3</sup> In addition, increasing rates of obesity appears to be contributing to higher rates of endometrial cancer in the younger age population as well.<sup>5</sup>

Many patients who have undergone hysterectomy for endometrial or early-stage cervical cancer require postoperative pelvic radiotherapy with a number of randomized trials showing improvements in local control and progression free survival.<sup>6</sup> To reduce surrounding normal tissue dosing and overall short-term and long-term side effects from treatment, radiation oncologists have transitioned away from conventional external beam plans with large treatment fields and have trended to more conformal plans. Much of this is made possible by intensity-modulated radiotherapy (IMRT) which has become increasingly used for postoperative cervical and endometrial cancers.<sup>7,8</sup> Studies have suggested significantly lower rates of acute and late toxicity using postoperative pelvic IMRT.<sup>9–12</sup> IMRT compared to 3D planning is currently being studied in an ongoing clinical trial (RTOG 1203).

IMRT requires precise targeting with tumor and organ delineation and therefore requires accurate daily setup to prevent under-dosing of tumor or over-dosing organs at risk.<sup>13</sup> The incorporation of daily image guidance (IGRT) has ensured that these conformal treatment plans align precisely to the targeted field.<sup>14</sup>

---

## 2. Aim

In 2008, the RTOG established a contouring atlas with consensus guidelines for postoperative pelvic IMRT for endometrial and cervical cancer.<sup>15</sup> The guidelines established two separate clinical tumor volumes (CTVs) encompassing the vaginal cuff and parametrial tissue based on the bladder being full and empty. This volume was defined as the internal target volume (ITV). The guidelines also recommend a 7 mm margin on all three axes of the target volume for radiation treatment for postoperative cervical and endometrial cancers. However, the concern we look to address may be that these margins are inadequate for patients with increasing body mass index (BMI) or other related factors. In our department, a number of postoperative cervical and uterine cancer patients undergo daily position verification using cone beam computed tomography (CBCT). Daily volume shifts from the original planning CT scan are then recorded. Based on our observation, patients with higher BMI tend to have greater treatment shifts. Therefore, the goal of this retrospective single-institution study was

to review daily CBCT shifts to better understand whether current recommended margins are sufficiently accounting for organ and tumor motion and if certain patient characteristics including BMI predict for greater motion.

---

## 3. Material and methods

### 3.1. Patient selection

Chart review of 94 consecutive patients treated with postoperative IMRT for endometrial or cervical cancer from 2012 through 2014 performed at our institution were reviewed. Of those, 18 patients, who had undergone daily cone beam computed tomography (CBCT) using kilovoltage (kV) imaging, were included in the study. All patients were treated using the Varian TrueBeam system (Varian Medical Systems, Inc.). We excluded patients without upfront surgery and those who did not undergo daily CBCT prior to each treatment. The 18 patients underwent a total of 457 radiation treatment sessions. The median number of treatments was 27. This retrospective analysis was reviewed and approved by the institutional review board.

### 3.2. Treatment volumes and planning

At the time of CT Simulation, all patients were set up supine, arms overhead, and a custom alphacraddle was made for daily immobilization. Tattoos were placed to be used daily during treatment for initial positioning with lasers. Treatment volumes were created using the ASTRO 2008 gynecologic postoperative consensus guidelines. The vaginal and parametrial clinical tumor volume (CTV) was contoured with full and empty bladder scans. The vaginal cuff CTVs from the full and empty bladder were combined to create an internal target volume (ITV). Lymph node CTV, included a 1 cm expansion off the common, internal, and external iliac vessels including any clinical or pathologically enlarged lymph nodes. An expansion of 7 mm was generated from the nodal CTV and ITV to create the planning tumor volume (PTV). The treatment plans were generated using the Varian Eclipse Planning System v11.

### 3.3. Daily imaging

All patients were treated with a full bladder; patients were instructed to have 300 ml of water one hour prior to treatment. Daily kilovoltage CBCT scans were used for pretreatment verification and setup confirmation. The CBCT scans were compared and matched to the full bladder simulation scan used for treatment planning, aligning to bony pelvic landmarks for nodal coverage and soft tissue for vaginal cuff matching. Three-dimensional image registration was used. Automatic registration followed by manual adjustments were performed daily by therapists and verified by physicians. Shifts were recorded in the x axis (lateral dimension), y axis (superior–inferior dimension) and z axis (anterior–posterior dimension). These daily recorded coordinates were compared to the planned isocenter placed on the original simulation scan used for planning. Daily changes in the X, Y, and Z direction were recorded.

Download English Version:

<https://daneshyari.com/en/article/1855530>

Download Persian Version:

<https://daneshyari.com/article/1855530>

[Daneshyari.com](https://daneshyari.com)