

Gynecologic Oncology

Rectal contrast increases rectal dose during vaginal cuff brachytherapy

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ABSTRACT

PURPOSE: To evaluate the impact of rectal dose on rectal contrast use during vaginal cuff brachytherapy (VCB).

METHODS AND MATERIALS: A retrospective review of gynecology patients who received some brachytherapy fractions with and without rectal contrast was carried out. Rectal contrast was instilled at the clinician's discretion to increase rectal visibility. Thirty-six pairs of CT scans in preparation for brachytherapy were analyzed. Pairs of CTs were segmented and planned using the same parameters. The rectum was always defined from 1 cm above the cylinder tip up to 1.5 cm below the last activated dwell source position. An individual plan was computed at every VCB fraction. A set of values (D_{\max} , $D_{0.1cc}$, D_{1cc} , and D_{2cc}) derived from dose-volume histograms were extracted and compared according to the rectal status.

RESULTS: Rectal volume was 26.7% larger in the fractions with rectal contrast. Such an increase in volume represented a significant increase from 7.7% to 10.4% in all parameters analyzed except D_{\max} dose-volume histogram.

CONCLUSIONS: Avoiding rectal contrast is a simple way of decreasing the rectal dose parameters of VCB, which would mean a better therapeutic ratio. Results also suggest that action directed at maintaining the rectum empty might have the same effect. © 2016 American Brachytherapy Society. Published by Elsevier Inc. All rights reserved.

Keywords:

Endometrial cancer; Vaginal cuff brachytherapy; Rectal contrast; Dose-volume histogram

Introduction

Adjuvant vaginal cuff brachytherapy (VCB) is one of the main postoperative treatments for endometrial neoplasms, due to the local control achieved and with fewer adverse effects than external beam radiotherapy (1–3). Analysis of recurrence patterns in Stage I endometrial cancer has demonstrated a low rate of isolated pelvic nodal recurrences after postoperative VCB, distant metastasis being the predominant failure site (4). Before low-dose-rate

(LDR) brachytherapy, rectal evacuation is advisable because it is a long-lasting procedure that requires the patient to be admitted into hospital for several days. On the other hand, this is not necessary before high-dose-rate (HDR) brachytherapy, which is an outpatient procedure lasting just a few minutes. Because of the random nature of the rectal volume during HDR fractions, higher doses due to rectal distention are less likely to produce adverse clinical outcomes in a fractionated schedule than a sole continuous irradiation fraction. Treatments delivered in a single fraction, like LDR, have no way to modify the rectal status. The American Brachytherapy Society (ABS) has not made any clear recommendations on rectal evacuation (5), and although several studies have addressed the effect of bladder filling volume on bladder doses during VCB (6, 7), similar analysis focused on rectal volume is scarce.

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Conflict of interest: None.

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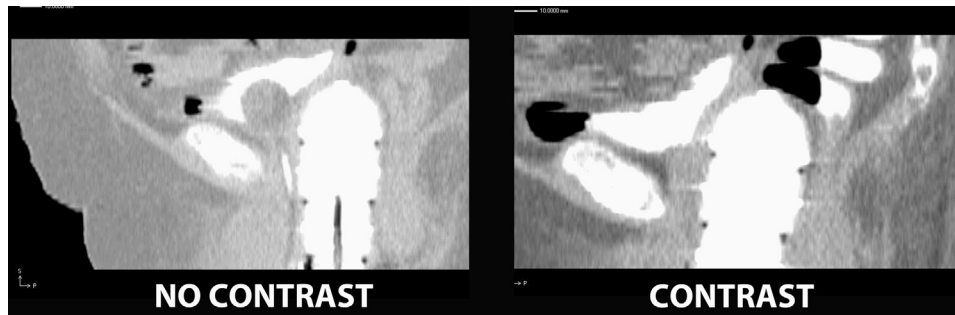


Fig. 1. CT axial images showing the same patient without and with rectal contrast with the vaginal cylinder *in situ*. Rectum contrast produces an increase in volume due partially to air.

Previous studies by our group have demonstrated a positive relationship between rectal volumes and rectal doses during VCB (8) and a beneficial effect on rectal dose deposition associated with rectal gas pocket removal (9). We found a significant reduction on rectal dose-volume histogram (DVH) parameters related to volume diminution by gas pocket removal. The dose percentage related to the prescribed dose decreased with gas removal from 112% to 101% for D_{1cc} , D_{2cc} reduced from 101% to 90% and V_{5Gy} reduced from 2.51 mL to 1.32 mL with gas removal. Although the usual clinical VCB procedure does not involve a rectum opacification with contrast, it has sometimes been advised, such as in the RTOG-0417 protocol (10, 11), to improve localization. Despite that, no analysis has evaluated the consequences of such practice.

From our previous data (8, 9), we hypothesized that there is an adverse effect on rectal doses of using rectal contrast related to higher rectal volumes. The purpose of the present study is to investigate using paired VCB applications the dosimetric consequences of rectal contrast instillation during VCB compared with unopacified rectal status.

Methods and materials

A retrospective chart review of gynecologic patients who received some HDR-VCB fraction with and without rectal contrast was performed, and DVH parameters were compared according to the presence of rectal contrast. The procedure details have been described elsewhere (12). In brief, all patients received postoperative HDR-VCB, using single channel vaginal cylinders with the largest diameters (Nucletron Vaginal Applicator Set # 085350, Elekta, Stockholm, Sweden) that comfortably fit inside the vaginal vault. Until 2012, a pelvic CT scan was routinely carried out immediately after every cylinder insertion, with a 2-mm slice thickness and no gap between slices, in the supine position, with a bladder foley catheter in place to instill dilute contrast medium (5 mL of Omnipaque350 [GE Healthcare Bio-Sciences] in 45 mL of saline solution) into the bladder. Rectal contrast medium (2 mL of Gastrografin [Bayer] in 20 mL of saline solution) was instilled at the clinician's discretion to increase rectal

visibility during segmentation. Until we obtained these results, there was no formal policy into the department related to rectal filling or the use of rectal contrast, and various radiation oncologists shared gynecologic brachytherapy patient treatments. Cylinders were positioned to remain parallel to the craniocaudal axis of the patient. Cylinder size and position were constant between fractions. Patients were eligible for review if there was a brachytherapy fraction CT scan either with or without a rectal contrast.

CT images were transferred to a 3D treatment planning system (Oncontra v.4.1, Elekta, Stockholm, Sweden). To improve analysis and for the purposes of the study, because doses, active lengths, prescription depth, and number of fractions varied among patients, every image set was recontoured by the same researcher and each brachytherapy

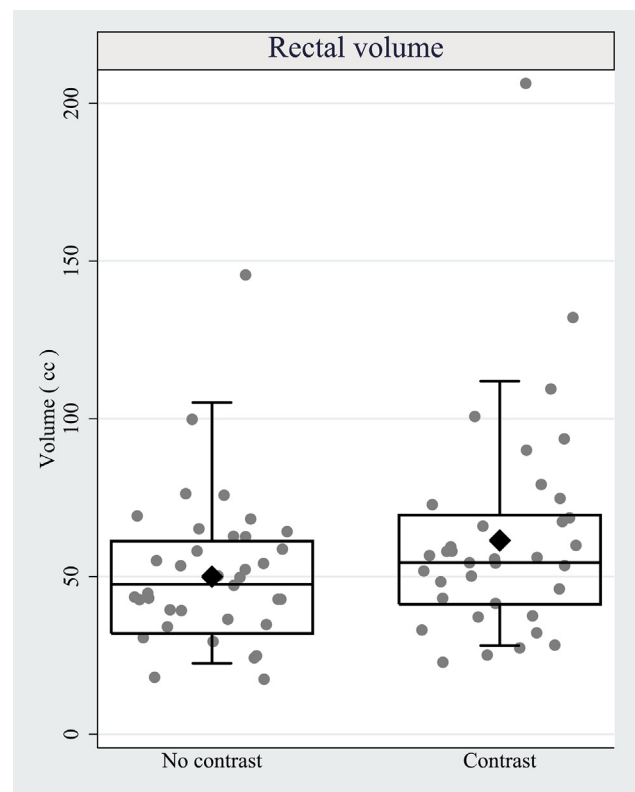


Fig. 2. Box plot showing rectal volume according to rectal contrast status.

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