

Purpose: Definitive radiation therapy for locally advanced cervical cancer involves both external beam radiation therapy (EBRT) and high-dose-rate (HDR) brachytherapy. There remains controversy and practice pattern variation for the optimal radiation prescription dose to metastatic pelvic lymph nodes. This study investigates the contribution of the pelvic lymph node dose from HDR brachytherapy. We also examine the variation of the lymph node prescribed dose and actual delivered dose as determined from the EBRT and brachytherapy plans.

Materials and Methods: From September 2007 to October 2011, 68 patients were treated with curative intent. Of these, 17 patients with 36 positive pelvic lymph nodes were included in this retrospective analysis. All patients were treated with EBRT to the pelvis with a supplemental boost to the involved pelvic node, plus HDR brachytherapy. Pathologically involved lymph nodes were contoured on the planning EBRT image as well as the 4 to 5 brachytherapy planning images. The mean received dose of each lymph node from the EBRT and brachytherapy plans was recorded. The Equivalent Dose in 2-Gray Fractions (EQD2) was calculated using the equation $EQD2 = D \times [(d + \alpha/\beta)/2 \text{ Gy} + \alpha/\beta]$ where D is total dose, d is dose per fraction and α/β -ratio is the dose at which the linear and quadratic components are equal. A student t-test was performed to determine if the mean received dose was significantly different from the mean intended prescribed dose and the mean intended EQD2.

Results: The average prescribed dose from the EBRT, including the initial pelvic fields and boost contribution, was 54.09Gy. The average prescribed HDR dose to International Commission on Radiation Units (ICRU) point A was 26.81Gy. The average dose delivered to the involved pelvic lymph nodes from EBRT and brachytherapy were 54.25Gy and 4.31Gy, respectively, with the corresponding EQD2 of 53.45Gy and 4.00Gy. Therefore, there was no statistically significant difference between the means of the received individual lymph node dose and intended prescribed pelvic lymph node dose for the EBRT and brachytherapy plans ($p < 0.05$). The similar results between the received dose and the EQD2 were observed.

Conclusions: The equivalent dose contribution to the involved pelvic lymph nodes in locally advanced cervical cancer from HDR brachytherapy was 4.00Gy. Our study shows that is the HDR contribution is 7% of the total EQD2 (57.45Gy). The HDR contribution needs to be accounted for when prescribing the EBRT boost dose to pelvic lymph nodes for the optimal therapeutic dose.

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Robust Applicator Registration for Interstitial Gynecologic Brachytherapy

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Purpose: We present a method for robust localization of the Syed-Neblett gynecologic brachytherapy applicator in intraoperative Magnetic Resonance (MR) imagery by alignment with its computer aided design (CAD) model. This alignment allows us to visualize “virtual needles” prior to the actual insertion.

Materials and Methods: Previously, we reported initial development of a software module named “iGyne” using the free and open source software platform 3D Slicer (<http://www.slicer.org>). Within iGyne, we reported a registration method based on user-initialized correspondences between 3 points, followed by Iterative Closest Points (ICP) surface registration of the Syed-Neblett template. In this work, we provide additional information to the registration method by including the obturator in the process. Specifically, we have added to the iGyne software module a step that allows the user to draw rough “gestures” — one inside the obturator, and one outside it — and then uses the *GrowCut*

algorithm to automatically segment the obturator from the rest of the image. As an intermediate step, a 3D model is generated from the segmented label map of the obturator, and then an ICP registration is used to register the surfaces of both the template and obturator CAD models against their segmentations in the MR images.

Results: We applied this method to six T2-weighted MRI datasets acquired using a Siemens 3T scanner in the Advanced Multimodality Image-guided Operating (AMIGO) suite at Brigham and Women's Hospital. We computed the quadratic mean distance (Root Mean Square error) between corresponding resulting points of a manually obtained registration (ground truth), and of both registration methods described above. We obtained a significant improvement in accuracy compared to the previous (template-only) registration method. The RMS error dropped by more than 70% (from 14mm to 4mm). The Figure illustrates a representative case. To support open science, all data sets used in this study have been anonymized and made available freely and publicly at <http://www.spl.harvard.edu/publications/item/view/2227>.

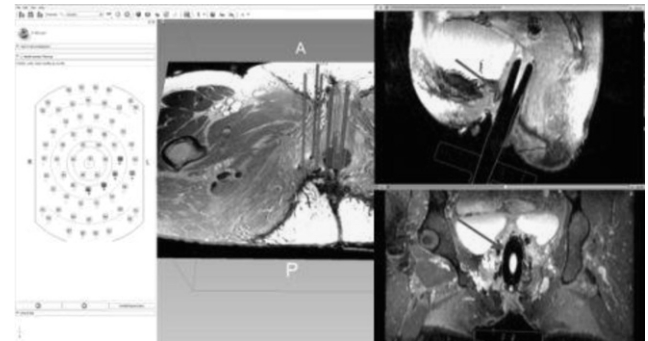


Figure. Interface allowing simulating insertion of needles (left image). Result of the refined ICP registration of the obturator and the template (right images).

Conclusions: In this contribution, we present a registration method for CAD models of the Syed-Neblett template and the obturator for interstitial gynecologic brachytherapy that is available in the iGyne module of the open source software package 3D Slicer. Areas of immediate future work include the further improvements to the accuracy of the method so that it is less than 2mm Root Mean Square error.

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The Impact of Various Modalities of Treatment for Carcinoma of the Uterine Cervix on Sexual Function Assessed Using the LENT SOMA Scales

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Purpose: To assess the outcome and quality of life of patients of carcinoma uterine cervix treated with multimodality therapy using the LENT SOMA scores.

Materials and Methods: Ethical approval was obtained from the CMC & H, Ludhiana Ethics Committee. The study was prospective and patients who were treated between January 1995 to December 2007 and coming for followup were included in this study. A total of 85 patients were accrued comprising 6 stage IB, 6 stage II A, 25 stage II B, 2 stage IIIA, 45 stage III B and 1 stage IV A disease. Sixty-six patients were treated with radiotherapy in which 45 patients received chemotherapy with radiotherapy and 19 had surgery prior to post-operative radiotherapy. The mean age was 47.81 years with a range of 25–68 years. Radiotherapy was given according to the Manchester school. Completion of LENT SOMA scale vagina sub-section (including sexual dysfunction) and Statistical analysis was done.

Results: Completion of questionnaires: From a consecutive series of 92 patients, 7 patients' data were not adequate. Three patients were reported