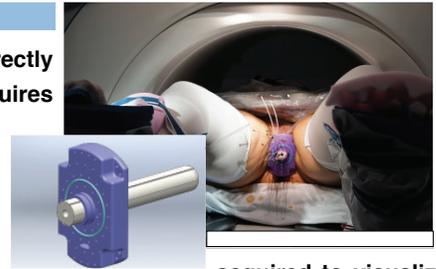


Concept Development and Feasibility Study of Image-based Needle Guidance for MR-Guided Interstitial Gynecologic Brachytherapy in AMIGO

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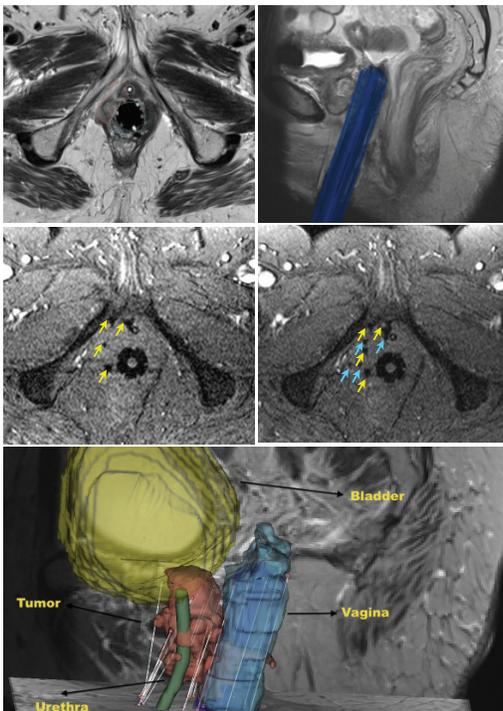
OVERVIEW

Interstitial gynecologic brachytherapy, the placement of radioactive isotopes directly into a cancer of the uterine cervix or vagina in order to eradicate the cancer, requires insertion of hollow catheters with introducers into the tumor. The catheters are guided into place through holes in a template sutured to the patient's perineum as shown on the right [1]. In the newly constructed Advanced Multimodality Image-Guided Operating (AMIGO) suite at Brigham and Women's Hospital and Dana Farber Cancer Institute, intra-procedural Magnetic Resonance (MR) images are acquired to visualize the catheters in relationship to the tumor. The goal of this project is to develop algorithmic, software, and hardware technology to aid catheter placement during MR guided interstitial gynecologic brachytherapy in AMIGO.



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At the start of the procedure, an MRI series consisting of T2 Axial, Sagittal, and Coronal slices is acquired (TR 4000, TE 101, Flip Angle 150, Slice Thickness 4mm) with the obturator in place. The tumor, the organ of interest (OAR), the obturator and the template are segmented as shown on the left using the free and open source software platform 3D Slicer [2].

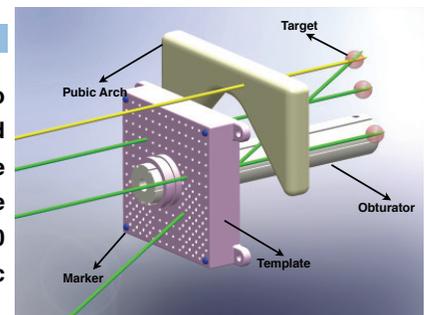
Alternating T2 and Gradient Echo (GRE) images (plane orthogonal to obturator) are acquired to show the advancing catheter and surrounding anatomy as shown on the left. Each of these MRI images is registered to the initial MRI, the catheters are marked, and rendered in relationship to the previous segmentations.

At the end of the insertion, a T2 weighted MRI series is obtained for confirmation. This series is registered to the initial MRI image and the catheter positioning validated.

This has been tested retrospectively, under IRB approval, on data obtained from the first AMIGO gynecologic brachytherapy procedure.

A CONCEPT FOR MODIFICATIONS TO TEMPLATE AND OBTURATOR

The figure on the right illustrates our concept model for a template and obturator to improve catheter access around the pubic arch area, as well as image based registration. To facilitate image based registration, MRI visible markers are embedded at all corners of the template as well as two on the obturator. These markers fully define catheter insertion position. Additional holes with upwards 30 degree angle have been created, for targeting areas superior ("behind") to the pubic bone.



REFERENCES

1. Gynecologic Radiation Therapy: Novel Approaches to Image-guidance and Management. Akila N. Viswanathan, Christian Kirisits, Beth E. Erickson, and Richard Pötter. Springer. ISBN---13: 978---3540689546
2. 3D Slicer software website <http://www.slicer.org>



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