

Temporal Changes of Tumor and Normal Uterus during Radiation Therapy in Cervical Cancer: Significance for Imaging-based Brachytherapy

Grecula JC, MD¹, Mayr NA, MD¹, Koch RM, MD¹, Wang JZ, PHD¹, Zhang H, PHD¹, Montebello JF, MD¹, Poetter R, MD², Erickson BA, MD³, Haie-Meder CM, MD⁴, Yuh WTC, MD¹

¹The Ohio State University, USA, ²Medical University of Vienna, Austria, ³Medical College of Wisconsin, USA, ⁴Institut Gustave-Roussy, France

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PURPOSE

Image-based brachytherapy is a novel concept for optimal target delineation and dose prescription in brachytherapy for cervical cancer. Size and location of the tumor and its relationship to normal uterus and endometrial canal *both* prior to therapy and at the time of brachytherapy are critical for target delineation, tandem loading and brachytherapy dose prescription. This study assessed temporal radiation-induced changes of these imaging parameters relevant for target delineation and dose prescription in image-based brachytherapy.

Pre-therapy (left) and at 45 Gy (right)

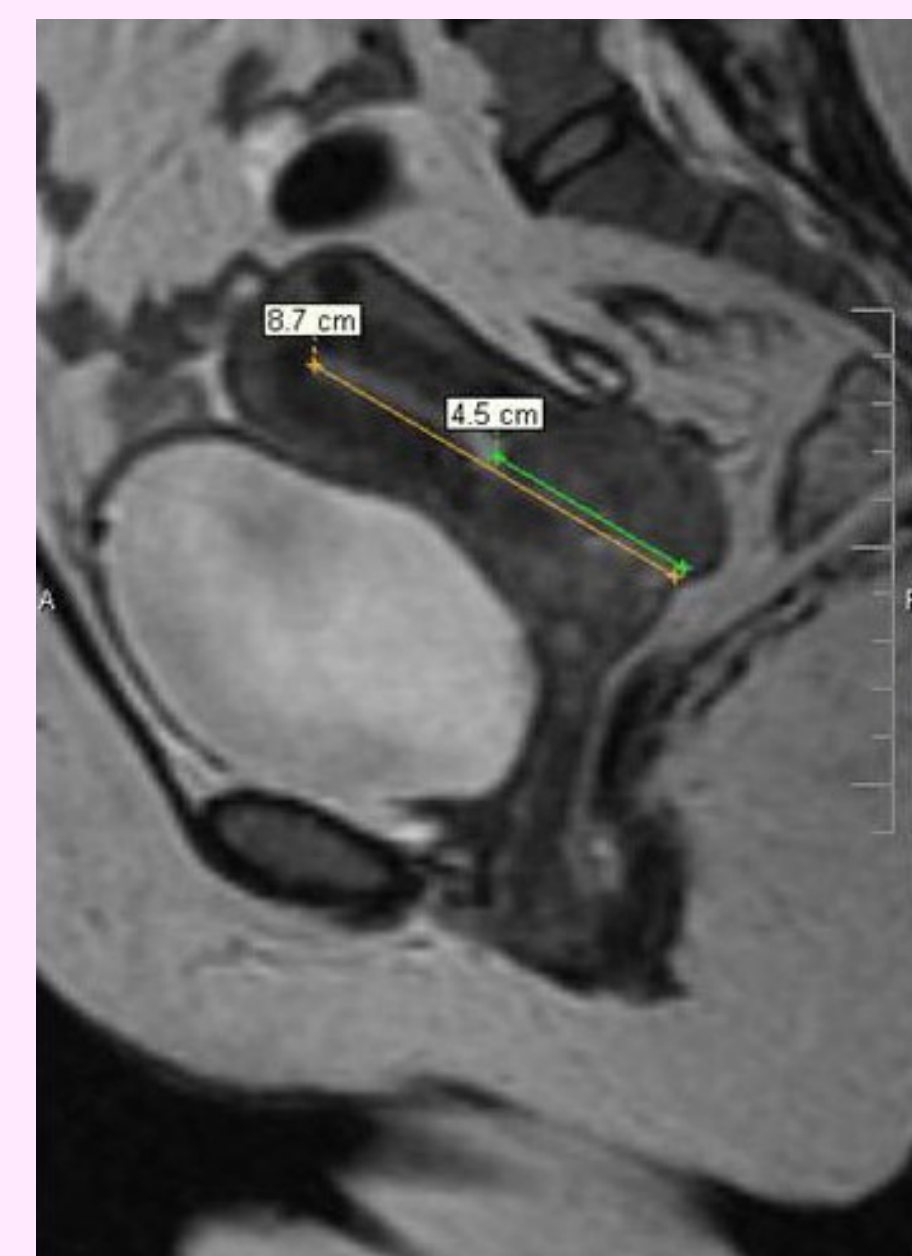


Fig. 1

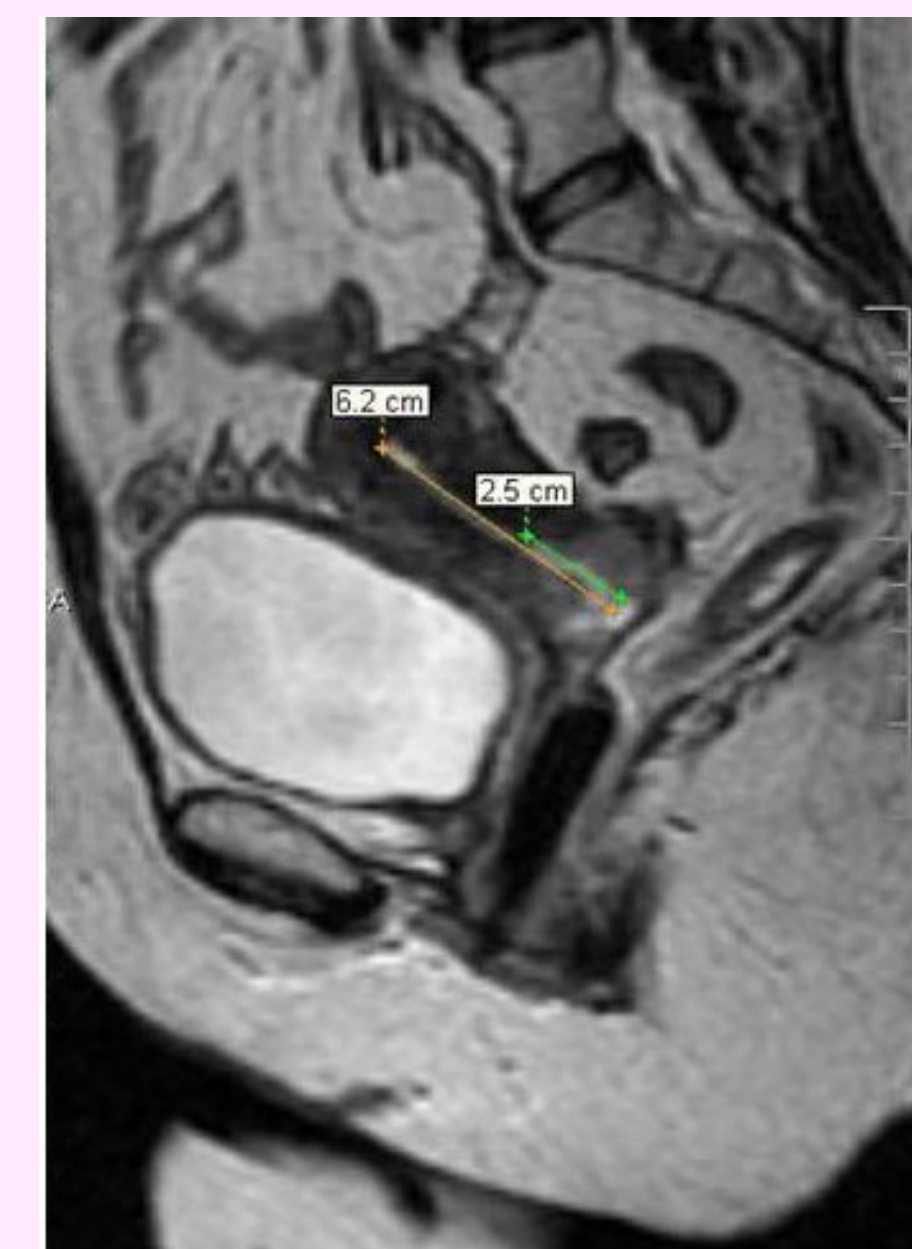


Fig. 2

Acknowledgement
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RESULTS

All measured imaging parameters, except the normal uterus, showed progressive decrease during the course of radiation therapy (Figs. 1-2).

The pattern of decrease in linear extent and volume was highly variable. The uterine canal length decreased from a mean of 7.8 cm pre-therapy (range: 4.1-11.8 cm) to 7.1 cm (range: 4.2-10.2 cm) at 20-25 Gy, and to 5.8 cm (range: 3.0-9.1 cm) at 45-50 Gy. Regression of the linear tumor extent along the endometrial canal was not proportional to the uterine canal length and occurred more rapidly from 4.1 cm pre-therapy to 3.5 cm (range: 1.2-7.1 cm) at 20-25 Gy, and to 1.6 cm (range: 0-4.8 cm) at 45-50 Gy (Fig. 3). The ratio of tumor length along the canal to canal length decreased from 54% (27-88%) pre-therapy to 49% (21-89%) and 29% (0-66%), respectively. The relative volume component of normal uterus increased early in therapy at 20-25 Gy and decreased later at 45-50 Gy in a variable pattern (Fig. 4).

MATERIALS AND METHODS

Linear and volumetric measurements of uterus and tumor were performed in 90 MR studies of 30 cervical cancer patients. Each patient had three serial MRIs, pre-treatment, at 20-25 Gy, and at 45-50 Gy. Volume of tumor and normal uterus, length of the uterine canal and extent of tumor along the canal were measured and analyzed with respect to the three imaging time points.

Temporal Measurement of Tumor and Uterus during RT

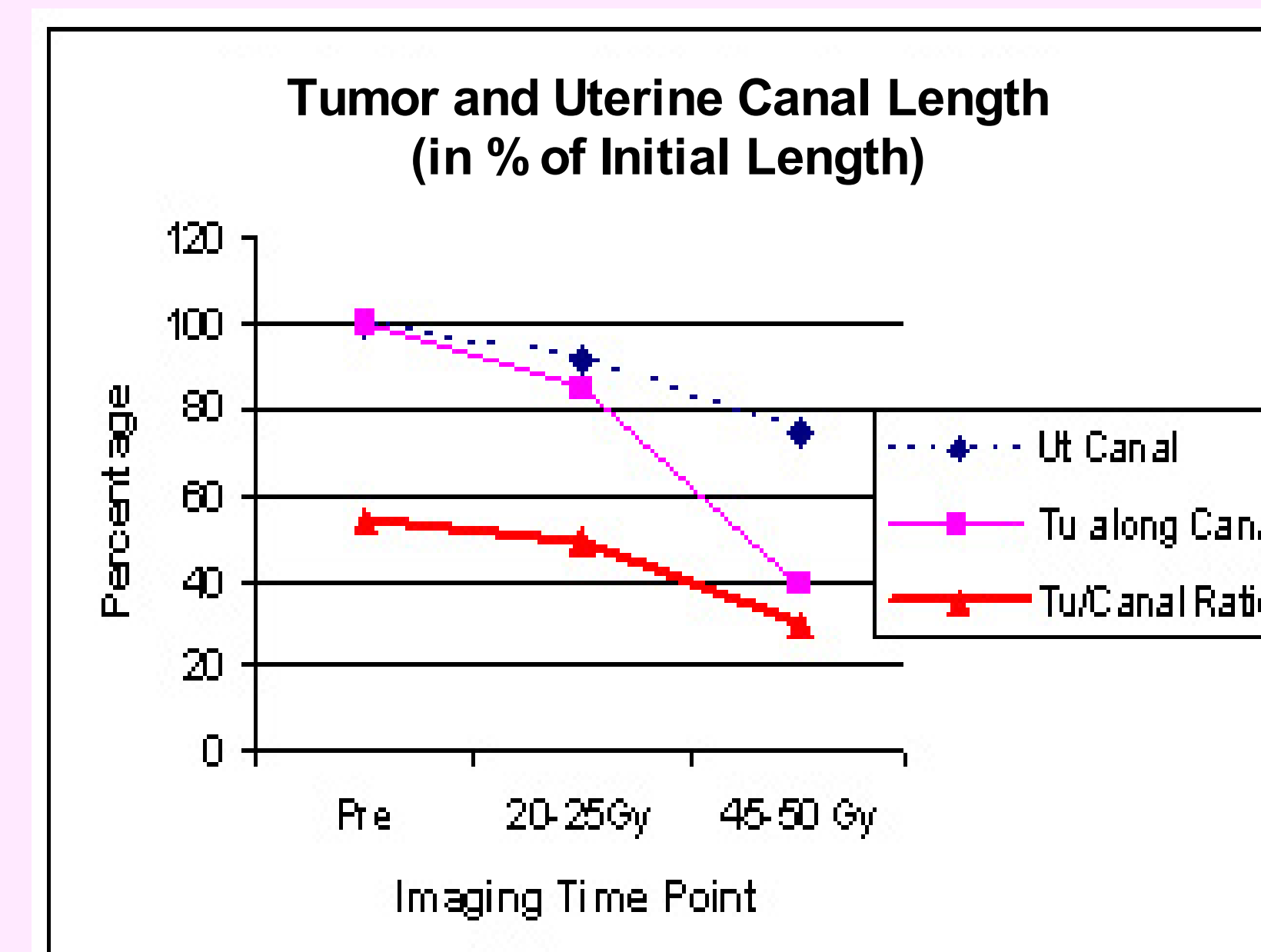


Fig. 3

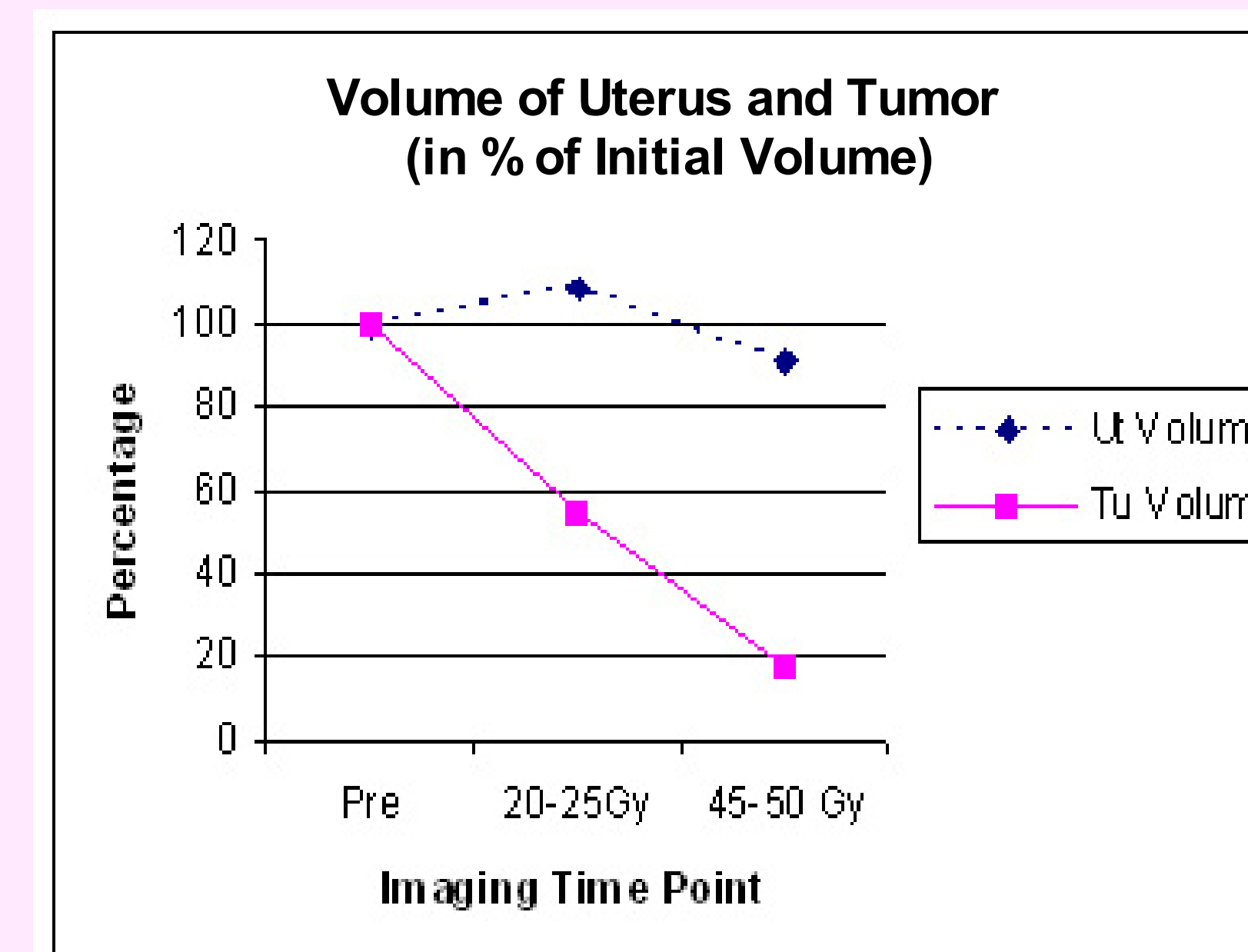


Fig. 4

CONCLUSION

Variable degrees of change in volume and linear extent occur in both tumor, endometrial canal and normal uterus, and are measurable at doses as low as 20-25 Gy, when brachytherapy is often initiated. This data confirms the need for repeat imaging and the importance of performing relative measurements of tumor and uterine canal pre-therapy and at the time of brachytherapy to enable individualized refined targeting and planning for image-based brachytherapy.