

## **Volume Estimation and Tracking Over Time (VETOT): Framework and application to the Fibroid Growth Study (FGS)**

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**Objectives:** The objective of this work was to develop a software tool that could accurately and systematically assess uterine leiomyoma growth dynamics from Magnetic Resonance Images (MRIs).

**Methods:** In support of the FGS, we developed an innovative software tool (Volume Estimation and Tracking Over Time; VETOT) to track uterine leiomyoma volume changes and spatial distribution with respect to the uterus reference system. Up to four consecutive pelvic MRIs were acquired for each patient enrolled in the FGS. The first MRI was performed immediately after enrollment in the study. Follow-up MRIs were performed about 3 months, 6 months and 12 months after enrollment. VETOT was developed to address the lack of tools that could accurately and systematically track tumors over time. Our software package utilizes a rigid registration framework that allows a fast alignment of the uterus visible in two consecutive MRIs. The registration mechanism uses a set of landmarks consistently specified by the user across images. We also developed a segmentation framework that allows for assessment of uterine leiomyoma volume. The combination of these features presents an innovative approach to identify and track designated uterine leiomyomas across image series and to study potential volume changes. Additionally, each tumor studied using VETOT is identified within a coordinate system built using the set of landmarks defined by the user for registration purposes. This information will be used to generate a spatial distribution atlas.

**Results:** VETOT has been developed and validated. Volume assessment is performed with less than 5% error, and inter-user variability does not exceed 15%. VETOT is currently being utilized to assess growth dynamics for the FGS.

**Conclusion:** VETOT provides an optimal method to accurately assess uterine leiomyoma location and volume changes over time.