MRI Prostate Volumetry as a Surrogate for Transrectal Ultrasound Volumetry in Estimating Iodine – 125 Seeds in Brachytherapy: Inter-Observer Variability

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Introduction: The accurate measurement of in vivo prostate volume has gained greater importance with the development of prostate brachytherapy [1-4]. Prostate brachytherapy is a form of radiation therapy where radioactive sources (seeds) are placed percutaneously by using a transperineal approach to the prostate gland under ultrasonographic (US) guidance to treat early prostate cancer. Patient selection for such therapy is dependent on the size of the prostate gland. Patients with large glands are frequently unsuitable for brachytherapy for technical reasons and because of an increased side-effect profile [2-3]. Furthermore, in most cases, the number of seeds ordered is determined on the basis of the outpatient gland volume measurement. The number of radioactive seeds placed at brachytherapy is critically dependent on the prostate volume [4] {Al-Qaisieh, 2006 #4851}. The purpose of this study was to evaluate inter-observer variability in assessment of prostate volumetry with and without endorectal MRI.

Materials and Methods: The institutional review board issued a waiver of informed consent for this HIPAA-compliant study. 79 men underwent endorectal MRI (Fig. 1) and 25 of them also had MRI without endorectal coil. The prostate three dimensions were on the basis of radiologists' written reports and re-measured by a radiologist with 9 years of research experience in MRI of the prostate. Prostate volume was estimated by using the conventional prolate ellipsoid formula (length × height × width × [π/6]) and the modified bullet shape formula (length × height × width / 4.8). A reference standard for prostate volume on endorectal MRI was calculated by using volumetry technique (prostate slice area × slice spacing).

Results: The volume difference was greater in prostates with a mean measured volume ≥ 30 mL than in prostates with a mean measured volume < 30 mL. The volume difference was greater between the experienced and less experienced observers (5.00 mL) than between the experienced observers (2.96 mL) ($p = 0.01$). The frequency of volume difference > 5 mL was greater between the experienced and less experienced observers (35%) than between the experienced observers (7%) ($p < 0.01$)..

Conclusions: The MRI prostate volume difference was greater between the experienced and less experienced observers than between the experienced observers. The MRI prostate volume measurement from experienced radiologist may reduce inappropriate patient selection as a surrogate for transrectal ultrasound volumetry in estimating Iodine – 125 seeds in brachytherapy.

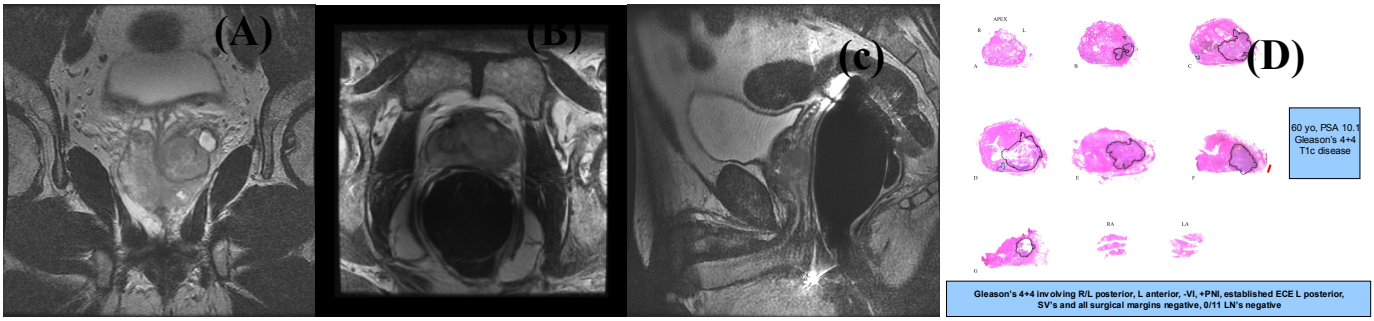

Fig. 1: Endorectal MRI in 60-year-old man. A and B and C, volume, superior-inferior (SI), medio-lateral (ML) and antero-posterior (AP) distances of prostate were 152.7 mL, 76.3 mm, 67.9 mm, and 56.3 mm by experienced observer (A, in coronal plane; B, in transverse plane; C, in sagittal plane;) and 118.5 mL, 73 mm, 66 mm, and 47 mm by less experienced observer. Between experienced and less experienced observers, difference was 34.2 mL in volume, 3.3 mm in SI distance,1.9 mm in ML distance, and 9.3 mm in AP distance. D.Whole-mount step-section pathological map of the prostate.

References: [1] Hricak H. Br J Radiol 2005; 78 Spec No 2:S103-111. [2] Langley, et al. BJU Int. 2002 Feb;89(3):241-9.. [3] Knopp, et al. Invest Radiol 2005;40: 243–248. [4] Al-Qaisieh, Int J Radiat Oncol Biol Phys. 2006 1;65(1):304-7.