SF 06 GU-01 Update in prostate imaging
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The past, present, and future of TRUS and TRUS-guided biopsy

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The main indications for the referral of the patients for TRUS are evaluation for prostate cancer and guidance for prostate biopsy.

Sonographic Anatomy and Technique

During transrectal prostate scanning, multiplanar imaging in semicoronal, axial, and sagittal projections can be performed by means of the biplane probes with a combination of endviewing and side-viewing transducers. Importantly, TRUS also enables the operator to perform various diagnostic and therapeutic interventions for prostate cancer, as it can provide better resolution compared to the other routes of ultrasound scanning.

Prostate Cancer

Prostate cancer is a significant cause of cancer-related death in men. Although, early detection provides better management of the disease, it may also cause the detection of "insignificant cancers" in addition to the significant ones. Although TRUS has been considered as a the main method for biopsy guidance, its low positive predictive value in diagnosing malignancy poses as a major drawback for its use.

Gray Scale Ultrasound

The classical lesion representing prostate cancer is a hypoechoic one, though an isoechoic or hyperechoic appearence may also be consistent with the disease. Unfortunately, a concurrent benign prostate hyperplasia may limit the utility of TRUS for the evaluation for prostate cancer due to its mixed echo pattern or compression effect on the peripheral zone.

Color Doppler Ultrasound

Color Doppler ultrasound (CDUS) may be helpful for the differentiation of low-risk, hypovascular tumors from high-risk, hypervascular tumors, as the latter group is associated with hypervascularity representing higher Gleason tumor grades implying higher risk for extraprostatic spread. However, targeted prostate biopsy solely depending on high-frequency color or power Doppler imaging is not recommended, as the technique has inherent risk of missing a significant number of cancers.

Power Doppler Ultrasound

Power Doppler ultrasound (PDUS) has not been found to be superior to CDUS, though the technique can help more accurate sampling of the prostate by determining sites of focal hypervascularity. It has been reported to be useful only for targeted biopsies with limited number of biopsy cores.

Contrast Enhanced Ultrasound

Based on the fact that the increased microvessel density associated with angiogenesis in prostate cancer is below the resolution of conventional Doppler imaging, microbubble contrast agents may enable better visualization of prostatic microvasculature and cancerous prostate tissue in turn. Contrast-enhanced ultrasound (CEUS) may provide a decrease in the number of cores to be sampled by enabling targeted biopsies. Recently, flash replenishment technique in

contrast harmonic imaging and cadence-contrast pulse sequencing technology have been developed to improve the visualization of the microvasculature associated with prostate cancer. In spite of the aforementioned progress regarding CEUS technology, the role of CEUS in the routine clinical practice is questionable.

Elastography

On elastography, prostate cancer appears as a dark zone representing limited elasticity or compressibility. Depending on the hardness gradient and degree of elasticity loss, cancerous tissue can be differentiated from benign tissues. However, the technique is not sufficient yet to preclude the requirement for systematic prostate biopsies.

Transrectal Ultrasound-Guided Prostate Biopsy

TRUS-guided prostate biopsy has been accepted as the "gold standard" tool for the detection of prostate cancer. Abnormal digital rectal examination, elevated serum total PSA levels (> 4 ng/ml), and/or suspicious finding on TRUS examination are the main indications for the procedure. Technically, a zone-based systematic sampling of the regions of the prostate where the tumors are most likely to be located is performed. Classically, sextant biopsy protocol involves sampling of the cores at the midway between the lateral border and the median plane at the the levels of base, mid-gland and apex of the peripheral zone of the prostate, respectively. However, extended sampling protocols with 10–12 cores involving additional laterally directed cores at the aforementioned levels have been developed in time, to increase the diagnostic yield.

Patient Preparation and Anesthesia

In most centers, an antibiotic prophylaxis of cipro (ciprofloxacin) and a a bowel-cleansing rectal enema is used to minimize the risk of infection associated with the procedure. In the last decade, various methods of anesthesia to increase patient comfort during the procedure has been used with an increased frequency. In this regard, TRUS-guided periprostatic nerve blockage has been the most popular one. However, several complications like pain due to puncture with the needle, the need for repeated injections during the biopsy procedure, systemic lidocaine toxicity, distortion or artifact formation on TRUS image and erectile dysfunction can be noted.

References

1. Turgut AT, Dogra VS. Prostate carcinoma: Evaluation using transrectal sonography. In: Hayat MA, ed. Methods of cancer diagnosis, therapy and prognosis. 1st ed. New York, NA: Elsevier; 2008. p. 499-520
2. Heidenreigh A, Aus G, Bolla M, et al. EAU guidelines on prostate cancer. Eur Urol 2008;53: 68-80
3. Aigner F, Mitterberger M, Rehder P, et al. Status of transrectal ultrasound imaging of the prostate. J Endourol 2010;24: 685-91
4. Wijkstra H, Wink MH, de la Rosette JJ. Contrast specific imaging in the detection and localization of prostate cancer. World J Urol 2004;22: 346-50
5. Wink M, Frauscher F, Cosgrove D, et al. Contrast-enhanced ultrasound and prostate cancer; a multicentre European research coordination project. Eur Urol 2008;54: 982-92
6. Turgut AT, Dogra VS. Transrectal Prostate Biopsies. In: Dogra V, Saad W, eds. Ultrasound Guided Procedures. 1st ed. New York, NA: Thieme; 2009. p. 85-93
7. Sadeghi-Nejad, H., Simmons, M., Dakwar, G., and Dogra, V. Controversies in transrectal ultrasonography and prostate biopsy. Ultrasound Q 2006;22:169-175
8. Turgut AT, Olcucuoglu E, Kosar P, et al. Complications and limitations related to periprostatic local anesthesia before TRUS-guided prostate biopsy. J Clin Ultrasound 2008;36: 67-71
9. Turgut AT, Olcucuoglu E, Kosar P, et al. Power Doppler ultrasonography of the feeding arteries of the prostate gland: a novel approach to the diagnosis of prostate cancer. J Ultrasound Med 2007;26: 875-83