Imaging of Prostate Cancer

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Introduction

The popularity of imaging techniques to detect and to stage prostatic carcinomas has increased tremendously in the past decade. Nevertheless, most of the imaging techniques still have to compete with the digital rectal examination (DRE) and the serum concentration of prostate-specific antigen (PSA). There are two important reasons: the first is that the sensitivity of the imaging techniques now commonly used (i.e. transrectal ultrasonography, TRUS, and magnetic resonance imaging, MRI) lack sensitivity (a) to detect all cancers which originate in the prostate and (b) to stage the detected cancers accurately at a microscopic level. The second is that the imaging techniques lack specificity: many benign lesions closely resemble prostate carcinomas. For both reasons, biopsies are still required to obtain the final histological diagnosis.

The advantages and disadvantages of TRUS and MRI are discussed for the diagnosis and the staging of prostatic carcinoma.

The Diagnosis of Prostate Cancer with Imaging

Transrectal Ultrasonography

Techniques

A very convenient probe design is an endfiring, endviewing transducer which allows multiplanar imaging in oblique coronal and sagittal projections by simply tilting the transducer 90°. Other transducers allow biplanar imaging (axial and sagittal) by simply switching the direction of the crystals. Most of the electronic transducers offer the ability for transrectal colour Doppler and duplex Doppler US as well. The patients are preferably scanned in left lateral position. Needle guidance systems are available for the probes with guides that clamp onto the side of the probe and place electronic guide lines showing the needle path on the monitor. A common needle device for transrectal prostate biopsies is the automatic spring-driven biopsy gun supplied with an 18-gauge needle. This device allows precise needle localization and performs a core type of biopsy (17-mm length) with minimal manipulation and with remarkable safety due to the speed at which the biopsy is performed.

TRUS guidance for transrectal biopsy is a safe and relatively painless procedure for the patient and is more accurate than digitally guided biopsy, even for palpable lesions. It can be performed without significant complications on an outpatient basis with little or no prior warning. The use of a cleansing enema is sometimes recommended but is not mandatory. It has become standard practice to administer a rapidly absorbed antibiotic just prior to the biopsy. One of the newer broad-spectrum antibiotics (such as fluoroquinolone) will almost completely eliminate the risk of major complications.

Prostatic Carcinoma

In the typical case (≥T2), prostate cancer is a hypoechoic lesion that originates subcapsularly in the peripheral zone of the prostate gland (Figs. 1-3). Many other benign lesions, though, are hypoechoic as well. Therefore biopsies are necessary to obtain a histological diagnosis (Fig. 3). In most series approximately 50% of hypoechoic lesions in the peripheral zone are cancerous. Biopsy sensitivity is superior with US guidance for all categories of tumours, with an overall sensitivity of 88% compared to 74% with digital guidance [1].

Many cancers (as much as 40%-60%) are isoechoic, because of too small a volume (microfoci) and/or because of an infiltrative growth pattern. Isoechogeticity is the likely explanation that some of these cancers are palpable but not visible at TRUS. When an isoechoic cancer is present, it can be detected only when secondary signs of malignancy are appreciated. These include glandular asymmetry, which is most often obviated on transverse scans. Other secondary signs are capsular bulging and areas of attenuation. Nevertheless, none of them is specific for malignant disease. It is therefore
Fig. 1. A, B. Transrectal ultrasonography (TRUS); parasagittal scan of the right peripheral zone. Hypoechoic nodule (arrow) subcapsularly in the peripheral zone (A). Since differentiation from benign lesions is impossible, TRUS-guided biopsy is required (B). The needle course is clearly visible as it produces a white line throughout the lesion (arrowheads). Note that even in this particular case it is difficult provide objective criteria to stage this cancer accurately (confined or not; T2a at digital rectal examination and TRUS; proven pT2a at radical prostatectomy).

important to be aware of this pitfall and, if there is strong clinical suspicion of prostate cancer and a palpable nodule, to urge that a biopsy be performed even in the face of a negative TRUS examination.

Fig. 2. Transrectal ultrasonography (TRUS); transverse scan. Large hypoechoic cancer in the left peripheral zone clearly extending beyond the confines of the capsule (arrow) (T3a both at digital rectal examination and TRUS, proven pT3a at radical prostatectomy)

Often, prostate cancer is bilateral or, perhaps better, multifocal. The sonographer may not appreciate the multiple foci when encountering a well-defined hypoechoic lesion. This has been demonstrated in a multi-

Fig. 3. Transrectal ultrasonography: transverse scan after transurethral resection. Infiltrating hypoechoic cancer in the peripheral zone, probably not confined (T3a). Proven pT3a at staging biopsies