Prostate ultrasound and biopsy in the detection of prostate carcinoma

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Abstract
Purpose: To show our experience in prostatic transrectal ultrasound and transrectal ultrasound-guided biopsy over a ten-year period by a retrospective analysis in order to determine the detection rate of adenocarcinoma, to identify the distribution of positive samples in the gland, and to evaluate the usefulness of biopsy of nodules seen on imaging studies.
Materials and methods: A total of 1163 ultrasound and ultrasound-guided transrectal prostate biopsies were performed between March 2001 and November 2011. The population sample included patients who had undergone more than one biopsy. Data obtained from these procedures enables us to identify three age groups according to the incidence of pathology, to determine the most frequent location of adenocarcinoma within the prostate, and to evaluate the usefulness of prostatic nodules biopsy in the detection of adenocarcinoma.
Results: Analysis of the data has shown a 16% detection rate of adenocarcinoma in men under 50 years of age, 36% in patients between 50 and 65 years, and 48% in patients older than 65 years.
The left base of the prostate had the highest detection rate (15%), followed by left medium (14%), right base (14%), right medium (13%), left apex (12%), left lateral medium (12%), right apex (11%) and right lateral medium (10%).
Nodular images were found in 299 patients: 118 were positive for adenocarcinoma (Group A) and 181 were negative (Group B). Group A was divided into 3 subgroups: Subgroup A, with a positive result only in the nodule sample, and a negative result in the rest of the gland sample; Subgroup B, with a positive result in the gland samples but negative in the nodule sample; and Subgroup C, with results that were positive both in the gland and nodule samples.
Conclusion: Ultrasound and ultrasound-guided transrectal prostate biopsy play an important role in the evaluation of the prostate when adenocarcinoma is suspected. Based on our experience, ultrasound-guided prostate biopsy is the most useful method for the detection of adenocarcinoma, especially in patients over 65 years of age, and the nodule sample (if any) should be included in the eight-biopsy scheme.

Keywords
Ultrasound; Transrectal prostate biopsy; Adenocarcinoma; Nodule; Sample

Introduction
Prostate cancer is the most common cancer in men, excluding skin cancer. Globally, it is the sixth leading cause of cancer-related death in men, and the second one in the United States 1. Rates of prostate cancer detection vary widely across the world, but the highest rates occur in the developed countries. Since the introduction of the prostate-specific antigen (PSA) as screening method, the early diagnosis of prostate cancer through prostate biopsy has become a real fact.

Even if ultrasound-guided random prostate biopsy is the method used in our practise for the early detection of prostate adenocarcinoma, differences exist in detection rates of positive cases between different operators, as well as in the number of samples obtained in each procedure and the usefulness of focal lesions sampling visualized by transrectal ultrasound 2. The objective of this retrospective study is to show our experience in this procedure, highlighting the aforementioned issues.
Materials and methods

A total of 1163 transrectal prostate ultrasound scans with subsequent biopsy were performed between March 2001 and November 2011 in patients referred by the Urology Department in our hospital and by other institutions. Out of the total number of procedures, 306 corresponded to patients with two or more interventions: 98 patients underwent 2 biopsies, 28 patients underwent 3 biopsies and 6 patients underwent 4 biopsies.

Biopsies were performed after patient preparation: Patients were given an enema (Enemol) some hours before the procedure and were prescribed 500 mg ciprofloxacin every 12 hours for 5 days (beginning the day before the procedure) and a previous 6-hour fast period.

Before initiating the procedure, we reviewed the coagulation profile and urinalysis of each patient to confirm that the values were normal. We also checked that all patients had signed the informed consent, where all potential complications were discussed.

To perform the study, patients were placed in the left lateral decubitus position with their knees bent. First, an ultrasound is performed applying 2% lidocaine gel to measure prostate volume and weight and identify potentially suspicious images (fig. 1). Then biopsies are performed using an 18GA TRU-CUT needle (Pro Mag TM Angiotech) and an automatic biopsy gun (fig. 2) using an eight-core biopsy scheme (8 regions) (fig. 3). An extended 12- to 24-core biopsy scheme or a 36-core saturation biopsy scheme may be used as ordered by the referring physician (fig. 4).

Figure 1. Initial transrectal prostate ultrasound where longitudinal, transverse and anteroposterior diameters of the gland are measured for estimation of prostate weight.

Figure 2. On the left, a 18GA TRU-CUT needle (Pro Mag TM Angiotech) and, on the right, an automatic biopsy gun.

Figure 3. Eight-core biopsy scheme.

Figure 4. The needle is shown at the time of prostate biopsy sampling (white arrow).
Even if the number of samples obtained per procedure was variable in the patients studied, the eight-core biopsy predominated. This was the most widely used scheme, implemented in 714 patients (61%), while in all other patients 6-, 10-, 12-, 14-, 18- and 36-core biopsy schemes were used. Table 1 shows the schemes used and the number of patients in which such schemes were used.

When a hypoechoic area or lesion was found, 2 samples were collected and separately analyzed. Such samples were individually stored in bottles containing formalin, with the appropriate region labeled. Upon completion of the study, the patient stayed at the institution for approximately one hour for monitoring of potential adverse effects.

One hour after completion of the procedure, patients who had developed no complications were discharged with instructions on warning signs and symptoms. They were advised to contact the emergency service in case of severe pain, abundant and heavy bleeding, fever or acute urine retention. Relative rest was prescribed for 48 hours, and patients were reminded to complete the antibiotic schedule. They were also advised on a soft diet to avoid constipation.

### Results

Results of pathology analyses of each of the samples collected showed positive samples for adenocarcinoma in 363 procedures (31% of biopsies performed). If we group positive cases according to age range, we observe that 16% of cases correspond to patients younger than 50 years, 36% to patients between 50 and 60 years and 48% to patients older than 65 years. These data show a markedly higher incidence from the age of 65, since this group represents almost half of all patients with prostate adenocarcinoma.

In addition, an analysis of the distribution frequency based on the location of positive samples in eight-core biopsies showed that the left base of the gland was the location with the highest rate of positive results (15%), followed by the left mid-gland (14%), the right base (14%), the right mid-gland (13%), the left apex (12%), the left lateral mid gland (12%), the right apex (11%) and the right lateral mid gland (10%).

Finally, 299 patients had hypoechoic nodular lesions of the prostate and biopsy specimens were obtained from all of them. In order to evaluate the usefulness of the test, patients were divided into two groups: Group A (118 patients) with results that were positive both in the gland and nodule samples, and Group B (181 patients), with negative results.

Group A was in turn divided into 3 subgroups: Subgroup A, made up of 9 patients (7.7 % of Group A), with positive results in the nodule sample and negative results in the rest of the gland sample; Subgroup B, made up of 37 patients (31.3% of Group A), with results that were positive in the gland samples but negative in the nodule sample; and Subgroup C, made up of 72 patients (61% of Group A), with results that were positive both in the gland and nodule samples (fig. 5).

### Discussion

**Usefulness of the adenocarcinoma detection**

Our percentage of positive cases shows that in almost one-third of the patients undergoing transrectal ultrasound-guided prostate biopsy, they present some positive samples.
It should be noted that biopsies were indicated for abnormal PSA levels, previous suspicious biopsies (high grade PIN), suspicious digital rectal examination and a transrectal ultrasound scan showing the presence of a nodular image in the peripheral region. In addition, the above-mentioned rate of detection included those cases in which biopsies were performed twice, three and even four times.

Another important point is the analysis of incidence according to age: it appears to be markedly higher from the age of 65 and it represents almost half of all patients with prostate adenocarcinoma.

**Distribution of positive prostate biopsy samples**

There is still no standardized criterion on the number of samples that should be obtained during random prostate biopsy to be useful for urologists ordering the test or imaging specialists performing the scan. However, even if various random biopsy schemes have been developed, the most widely used are the 6-, 8-, 12-, 24- and 36-core biopsy schemes. At our institution, based on the experience and studies that confirm its efficiency for an early detection of adenocarcinoma, the 8-core biopsy scheme (8 samples) is the scheme of choice, unless the requesting physician specifically states the number of samples when ordering a biopsy. Based on this scheme, the region most frequently affected by adenocarcinoma was the left base, with no significant differences being found from other regions of the prostate gland.

**Nodular images**

Most tumors are hypoechoic to the adjacent parenchyma, but not all areas that show these features have a malignant etiology. This reveals the low specificity of transrectal ultrasound at the time of elucidating diagnosis (fig. 6).

From this perspective, potential differential diagnoses for hypoechoic nodules by transrectal ultrasound include focal prostatic hyperplasia, granulomatous prostatitis and prostatic infarction, among the most common.

As regards the analysis of patients with nodular images and positive results in any of the samples, it should be noted that nodules that proved to be positive with their adjacent parenchyma being free of disease were interpreted as primary sites of disease. On the other hand, nodules that were negative with positive adjacent parenchyma were interpreted as non-specific. The rate of detection of primary sites of disease nodules was low (7%).

Likewise, no statistically significant differences were observed when comparing rates of detection in patients with nodules vs. patients with no nodules (p= 0.2377). This would indicate that, even if the prevalence of cancer found in prostate glands with nodules is slightly higher, there is no clear statistical association between hypoechoic lesions and prostate adenocarcinoma.

**Conclusion**

Given the high rate of positive cases, mainly in patients older than 65 years, transrectal prostate biopsy is an essential method for the diagnosis of prostate adenocarcinoma in selected patients (history of positive previous biopsy samples or abnormalities in PSA levels, digital rectal examination or transrectal ultrasound).

Furthermore, even if prostate adenocarcinoma can be found in biopsy samples from any of the eight regions sampled, it is more frequently detected in samples obtained from the left base.

Biopsy of prostate nodules found on transrectal ultrasound has low validity for the detection of prostate adenocarcinoma; nevertheless, it could be added to random sampling, considering that most positive biopsy findings occur in the rest of the prostate gland, independently of imaging findings.

**Conflicts of interest**

The authors declare no conflicts of interest.

**References**


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