Utility of Histoscanning™ prior to prostate biopsy for the diagnosis of prostate adenocarcinoma

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Abstract
Objectives: Histoscanning™ (HS) is a method of ecographic diagnosis of prostate cancer. We analyze the effectiveness of the HS realization prior to the biopsy for the prostate adenocarcinoma diagnosis.

Materials and methods: From August to October 2012 we have carried out a study with HS prior to the biopsies in 32 patients. In all cases sextants transrectal biopsies have been realized (two cores in each sextant) in the periphery zone. In those sextants in which there were suspicious areas with HS, the biopsies were addressed to those areas. Transperinealbiopsies were added to those zones placed in the half-front or apical prostatic zone. The medium age was 63.7 years (range 40–82) with a medium PSA of 8.0 ng/ml (range 3.5–36.2) and a medium prostatic volume of 46.6 cc (range 18.2–103.2). In eight cases it was the first biopsy, in 14 cases they were repetition biopsies and 10 patients had a previous diagnosis of prostate adenocarcinoma (8 in a program of active surveillance and 2 T1a in RTU of previous prostate).

Results: In the 32 patients a medium of 7.5 zones were biopsied (range 6–9) with a total of 239 zones studied. There were identified a medium of 3.2 zones with suspicious areas (ZS) with HS (range 2–5) with a total of 103 ZS. In 72 zones of 25 patients it was found adenocarcinoma or PIN (2 PIN, 11 score Gleason 6, 7 score Gleason 7, 3 score Gleason 8 and 2 score Gleason 9). There were 35 positive false zones in 20 patients (11 normal parenquima and 9 chronic inflammation). False negatives were produced in 5 zones in 5 patients (2 PIN, 2 score Gleason 6 and 1 score Gleason 7) although in all 5 cases adenocarcinoma was encountered (0 discovered) in other zones. The HS presented a sensibility of a 93.5% with a specificity of 79.5%. The positive predictive value was of the 67.35% with a negative predictive value of 96.5%.

Conclusions: In spite of being a selected series, with a high rate of patients with adenocarcinoma, the exploration with HS has presented a great sensibility and a high negative predictive value. These data, although they must be confirmed in less selected series, state that the prior
Utilidad de HistoScanning™ previo a biopsia prostática para el diagnóstico de adenocarcinoma de próstata

Resumen
Clasificación: HistoScanning™ (HS) es un método de diagnóstico ecográfico del cáncer de próstata. Analizamos la eficacia de la realización de HS previo a las biopsias para el diagnóstico de adenocarcinoma de próstata.

Material y métodos: Entre agosto y octubre de 2012 hemos realizado estudio con HS previo a las biopsias en 32 pacientes. En todos los casos se realizaron biopsias transrectales por sextantes (2 tomas en cada sextante) de la zona periférica. En aquellos sextantes en los que hubo áreas sospechosas con HS las biopsias se dirigieron a dichas áreas. Se añadieron biopsias transperineales en aquellas áreas situadas en la zona media-anterior o apical prostática. La edad media fue de 63.7 años (rango: 40–82), con un PSA medio de 8.0 ng/ml (rango: 3.5–36.2) y un volumen prostático medio de 46.6 cc (rango: 18.2–103.2). En 8 casos se trataba de primera biopsia, en 14 de biopsias de repetición y 10 pacientes tenían diagnóstico previo de adenocarcinoma de próstata (8 en programa de vigilancia activa y 2 T1a en RTU de próstata previa).

Resultados: En los 32 pacientes se biopsiaron una media de 7.5 zonas (rango: 6–9) con un total de 239 zonas estudiadas. Se identificaron una media de 3.2 zonas con áreas sospechosas (25) con HS (rango: 2–5), con un total de 103 ZS. Se encontró adenocarcinoma o PIN en 72 zonas de 25 pacientes (2 PIN, 11 score Gleason 6, 7 score Gleason 7, 3 score Gleason 8 y 2 score Gleason 9). Hubo 35 zonas falsos positivos en 20 pacientes (11 parénquima normal y 9 inflamación crónica). Se produjeron falsos negativos en 5 zonas en 5 pacientes (2 PIN, 2 score Gleason 6 y un score Gleason 7), aunque en los 5 casos se descubrió adenocarcinoma en otras zonas. El HS presentó una sensibilidad del 93,5% con una especificidad del 79,5%. El valor predictivo positivo fue del 67,35% con un valor predictivo negativo del 96,5%.

Conclusiones: A pesar de tratarse de una serie seleccionada, con alta tasa de pacientes con adenocarcinoma, la exploración con HS ha presentado una gran sensibilidad y un elevado valor predictivo negativo. Estos datos, aunque deben ser confirmados en series menos seleccionadas, indican que la exploración previa con HS puede ayudar tanto al diagnóstico en las biopsias como en el seguimiento en programas de vigilancia activa.

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Introduction

In case of clinical suspicion of prostate cancer (PCa) due to an elevation of serum PSA levels or an abnormal digital rectal examination, transrectal or transperineal prostate biopsies, which are laterally directed under ultrasound guidance, are recommended. The 12-sample procedure provides a prostate cancer detection rate between 24 and 44%.

HistoScanning™ (HS) is an ultrasound-based diagnostic method including tissue characterization technology based on spectral analysis and pattern recognition, which provides localization of low-volume tumor cells.

This report presents our results in the use of HS prior to prostate biopsies in order to improve their profitability.

Materials and methods

Between August and October 2012, a study was conducted with HS prior to prostate biopsies in 32 patients. The mean age of the patients was 63.7 years (range: 40–82). The average prostate volume was 46.6 cc (range: 18.2–103.2 cc). The average PSA level was 8.0 ng/ml (range: 3.5–36.2 ng/ml) before biopsy.

In 8 cases, this was a first biopsy due to elevated PSA levels or suspicious digital rectal examination; in 14 patients with previous negative biopsies this was a repeat biopsy due to elevated PSA, and 10 patients had a previous diagnosis of prostate adenocarcinoma (8 on active surveillance protocol and 2 with stage T1a malignancy at the time of TURP).

The procedure was performed under sedation using a laryngeal mask. First of all, we conducted an examination with HS, an immediate analysis of the results and prostate biopsies, which were performed in the same surgical procedure. A sextant scheme was used with 2 samples taken from each sextant for the transrectal biopsies (Fig. 1). The transperineal biopsies of suspicious areas which may not be accessible by transrectal approaches were subsequently performed, taking 2 samples from each suspicious area.

In this division into sextants, we considered any sextant with suspicious areas identified as such by HS to be suspicious sites. Apart from that, all sites where transperineal biopsies were performed were considered to be suspicious areas.
In order to calculate sensitivity, specificity, and positive (PPV) and negative predictive values (NPV), those sites where PIN or PCa were detected were considered positive regions; whereas all the other sites, including inflammatory regions or regions of atrophy, were considered negative ones.

This paper was approved by the Scientific Committee of our center, and all patients signed the corresponding informed consent forms to participate in the study.

Results

A total of 239 sites were biopsied, with an average of 7.5 biopsied sites per patient (range: 6–9). A total of 103 sites with suspicious areas of malignancy were detected with an average of 3.2 suspicious areas per patient (range: 2–5). PIN or PCa was detected in 25 of the 32 patients with a total of 72 positive regions. The Gleason score was 6 in 11 patients, 7 in 7 cases, 8 in 3, and 9 in 2 cases. PIN was also detected in other 2 patients (Table 1).

False-positive (FP) regions were detected in 20 of the 32 patients, with a total of 35 FP regions. Chronic inflammation was detected in 9 out of the 20 patients with FP regions, and parenchyma was normal in 11 patients. False-negative (FN) regions were found in 5 patients with a FN region in each of them. The Gleason score for these 5 FN regions was 7 in one case, 6 in 2, and PIN was detected in the other 2 cases (Table 1). The 5 patients with FN regions were diagnosed with PCa in other prostatic regions.

The exploration with HS showed a sensitivity of 93.5%, a specificity of 79.5%, a PPV of 67.35, and a NPV of 96.5% (Table 2).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Summary of biopsied areas in 32 patients of the findings obtained with HS and its correlation with the pathologic findings of the biopsies.</th>
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<tbody>
<tr>
<td>Number of cases</td>
<td>32</td>
</tr>
<tr>
<td>Biopsied areas</td>
<td>239</td>
</tr>
<tr>
<td>Suspicious areas</td>
<td>103</td>
</tr>
<tr>
<td>Positive areas</td>
<td>72 (n = 25)</td>
</tr>
<tr>
<td>Gleason Score</td>
<td>6 (n = 11)</td>
</tr>
<tr>
<td></td>
<td>7 (n = 7)</td>
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<tr>
<td></td>
<td>8 (n = 3)</td>
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<td></td>
<td>9 (n = 2)</td>
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<tr>
<td></td>
<td>PIN (n = 2)</td>
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<tr>
<td>False positive areas</td>
<td>35</td>
</tr>
<tr>
<td>False negative areas</td>
<td>5</td>
</tr>
<tr>
<td>Gleason Score</td>
<td>6 (n = 2)</td>
</tr>
<tr>
<td></td>
<td>7 (n = 1)</td>
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<td></td>
<td>PIN (n = 2)</td>
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<table>
<thead>
<tr>
<th>Table 2</th>
<th>Results of HS in terms of sensitivity, specificity, and positive predictive values (PPV) and negative ones (NPV).</th>
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</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>93.5%</td>
</tr>
<tr>
<td>Specificity</td>
<td>79.5%</td>
</tr>
<tr>
<td>PPV</td>
<td>67.3%</td>
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<tr>
<td>NPV</td>
<td>96.5%</td>
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</table>

Discussion

Traditional ultrasound examination of the prostate suffers from very low sensitivity in the diagnosis of areas suspicious for PCa, so standardized biopsies are random. On the one hand, this results in the presence of false positives in prostate biopsies (particularly in the case of tumors located in central and anterior regions) and, on the other hand, it does not enable an adequate estimation of volume or of tumor location.

In fact, when biopsies are repeated in patients under active surveillance, they change from positive to negative in 2/3 of the cases, and from negative to positive in 25% of the patients.

Different imaging methods have been used in order to improve tumor detection within the prostate. Contrast-enhanced Doppler ultrasound shows a diagnostic sensitivity similar to that of standardized biopsies (73.4% versus 72%), though the joint implementation of systematic biopsies and Doppler ultrasound-guided biopsies allows for an increase in detection rates from 27.5% to 37.6%. The disadvantages of this technique are the following: the cost of ultrasound contrast methods, low relative effectiveness, and its lack of usefulness at the transition zone, since changes of benign prostatic hyperplasia include hypervascularization zones that are indistinguishable from tumor hypervascularization zones.

Real-time elastography of the prostate provides a sensitivity of 60.8% and a specificity of 68.4%. Although the detection rate of elastography is higher than that of systematic biopsies (51.1% versus 39.4%), its relatively low sensitivity and specificity do not permit us to ignore standardized biopsies.9
In addition to the techniques mentioned above, based on transrectal ultrasound guidance, both choline PET and NMR have proven effective in diagnosing PCA. Choline PET provides high sensitivity for tumor localization, although its sensitivity for prostate cancer detection is only slightly higher than to that of 12-core biopsies (66% versus 61%).

Multiparametric NMR imaging with an endorectal coil provides an excellent resolution and achieves a sensitivity of 73% and a specificity of 89% for PCA diagnosis. By using a system that summarizes NMR data and ultrasound data obtained by perineal biopsy, Hadaschik et al. found a correlation between NMR results and histology in 71 of the 103 patients (68.9%), though NMR sensitivity for PCA in 410 suspicious areas was only 24.6%.

HS is a computer-aided, transrectal ultrasound-based exploration method which includes a system based on spectral analysis and pattern recognition that allows us to identify those areas suspected of being malignant. HS employs ultrasound scanning of the prostate and provides a 3-dimensional image of the prostate gland, along with a sagittal, transverse, and coronal view, highlighting suspicious areas in red (Fig. 2). This way, it can aid when planning both biopsies and a radical prostatectomy.

Braeckman et al. compared the HS findings with the results obtained from radical prostatectomy in 29 cases, achieving a sensitivity of 100% and a specificity of 80% (with HS), as well as a high correlation for determining multifocality and laterality. Simmons et al. found, with the same methodology, a sensitivity of 90% and a specificity of 72% for tumors bigger than 0.2 ml in 31 surveyed cases. Salomon et al. used HS in 80 patients before radical prostatectomy, thus demonstrating that the detection of foci larger than 0.2 ml in the pericapsular region with HS was associated with a 3.7-fold increase in the risk of positive surgical margins.

In our study, HS showed high sensitivity for PCA detection, which might improve the diagnostic yield of prostate biopsies amongst the general population, which may reduce the rate of false-negative biopsies and enable early diagnosis. On the other hand, a NPV of 96.5% allows us to virtually rule out the presence of PCa in areas not suspected of being malignant, which may have a significant impact on surgical planning. The main limitations of our study are not related to the small number of patients – 32 – since 239 prostate areas were evaluated, but to the fact that it is a selected population of individuals. Out of the 32 patients, 8 of the 32 patients had previously diagnosed PCa and were under active surveillance, and 2 patients had a history of stage T1a PCa diagnosed by TURP. That explains the high detection rate of PCa in our survey, 78.1% (25/32), much higher than those of other series. In spite of this, the values of HS obtained in our study in terms of sensitivity (93.5%), specificity (79.5%), PPV (67.3%), and NPV (96.5%) are consistent with those obtained in the series correlated with prostatectomy specimens.

Although our study shows very promising results, it will be necessary to increase the number of cases studied and, above everything, apply it to a less biased population in order to clearly define the possible benefits of HS when performing prostate biopsies.
Conclusions

In spite of being a selected series, with a high rate of patients with adenocarcinoma, the exploration with HS has presented a great sensitivity and a high NPV. Although these data must be confirmed in less selected series, they state that the prior exploration with HS can help both in the diagnosis of the biopsies and in the follow-up of programs of active surveillance.

Conflict of interest

The authors declare that they have no conflict of interest.

References