Diagnostic and Interventional Imaging (2017) xxx, xxx—xxx

ORIGINAL ARTICLE /*Genitourinary imaging*

Evaluation of MR imaging-targeted biopsies of the prostate in biopsy-naïve patients. A single centre study

J. Garcia Bennett [a,*], J.C. Vilanova [b], J. Gumà Padró [c], D. Parada [d], A. Conejero [a]

[a] *Department of Radiology, Hospital Universitari Sant Joan de Reus, Av. del Dr. Josep Laporte, 2, 43204 Reus, Spain*
[b] *Clínica Girona, Institut Catalan of Health-IDI, University of Girona, C. Lorenzana, 36, 17002 Girona, Spain*
[c] *Department of Oncology, Hospital Universitari Sant Joan de Reus, Av. del Dr. Josep Laporte, 2, 43204 Reus, Spain*
[d] *Department of Pathology, Hospital Universitari Sant Joan de Reus/IISPV/URV, Av. del Dr. Josep Laporte, 2, 43204 Reus, Spain*

KEYWORDS
Cancer detection;
Magnetic resonance imaging (MRI);
Prostate biopsy;
Prostate cancer;
Targeted biopsy

Abstract
Purpose: To evaluate the differences in prostate cancer detection rate and biopsy effectiveness between magnetic resonance imaging (MRI) target biopsy (TB) and transperineal standard biopsy (SB) in biopsy-naïve patients.
Material and methods: Between October 2014 and April 2016, 60 men with a mean age of 64.1 ± 6.7 (SD) years (range: 53—82 years) were prospectively enrolled. All patients underwent a prostate MRI study, evaluated by two radiologists, before undergoing the biopsy. A transperineal 12-core SB was carried out before TB, without the information from the MRI. The detection rate for all tumors and for clinically significant tumors (CS) was recorded. Sampling variables such as the proportion of cores positive for CS cancer (PCP-CS) and the maximum cancer core length (MCCL) were also calculated. The ability of MRI to predict the presence of a CS tumor at biopsy was studied using a sector analysis. Patients with negative biopsies were followed during a minimum of 12 months.
Results: The detection rate for SB and TB was 53.3% (32/60) and 46.7% (28/60) respectively for all tumors ($P = 0.289$) and 45% (27/60) in both techniques for CS tumors. TB obtained a larger PCP-CS ($P < 0.001$) and MCCL ($P = 0.018$). The sensitivity, specificity, positive predictive value, negative predictive value and cancer prevalence was 83.3%, 92.9%, 83.3%, 92.9% and 30% for

* Corresponding author current address: Hospital Universitari de Bellvitge, c/Feixa Llarga, sn, 08907 L'Hospitalet de Llobregat, Barcelona, Spain.
E-mail address: jrongarcia@yahoo.com (J. Garcia Bennett).

http://dx.doi.org/10.1016/j.diii.2017.06.010

Please cite this article in press as: Garcia Bennett J, et al. Evaluation of MR imaging-targeted biopsies of the prostate in biopsy-naïve patients. A single centre study. Diagnostic and Interventional Imaging (2017), http://dx.doi.org/10.1016/j.diii.2017.06.010

peripheral zone sectors and 43.8%, 97.1%, 70.0%, 91.8% and 13,3% for transitional zone sectors. The proportion of patients that showed an increase of PSA faster than 0.75 ng/mL/year after a negative biopsy was 26.1%.
Conclusion: Detection rate of prostate cancer did not show significant differences between a TB and a SB technique in biopsy-naïve patients. However, targeted prostate biopsies demonstrated a better sampling effectiveness thus reducing the cores needed to diagnose clinically significant tumors.

Magnetic resonance-imaging (MRI)-targeted biopsies (TB) of the prostate have the potential to increase the detection rate (DR) of prostate cancer and at the same time decrease the number of repeated biopsies. Studies involving patients with previous negative biopsies have reported higher DR of MRI-TB compared to standard biopsies (SB) [1—7]. This is, in part, explained by the detection of tumors located in areas undersampled by transrectal SB (apical and anterior tumors) [6,8] or transperineal SB (base tumors) [9] and has allowed MRI to be recommended before a repeated biopsy with a level of evidence of 1a and an A grade of recommendation [10].

A few studies have been published regarding biopsy-naïve patients. This population tends to have more lesions to biopsy, less number of anterior lesions and smaller prostate volumes compared to patients with repeated negative biopsies [3]. These patients may require more TB in smaller prostates. As a result, there might be fewer differences in cancer detection between a SB and an MRI-TB. However, TB can obtain a better sampling effectiveness compared to SB [11], reducing the number of cores needed to diagnose a prostate cancer, which, in turn, minimizes the costs of the biopsy procedure and improves the tolerance of an outpatient biopsy. With a need to increase the DR of prostate cancer in first biopsies (up to 60% can be negative [12]) it is necessary to consider whether TB is cost-effective in this population.

The aim of this study was to evaluate the differences in prostate cancer detection rate and biopsy effectiveness between an MRI-TB and a transperineal 12-core SB, in biopsy-naïve patients. Secondary objectives include the evaluation of MRI to predict clinically significant (CS) tumors, the follow-up of patients with a negative biopsy and the assessment of pain and complications during the biopsy.

Materials and methods

The study design followed the START recommendations [13].

Patients

We obtained institutional review board approval for this prospective study. All patients were given written informed consent and had not been included in any previous study. Inclusion criteria were patients with suspicion of prostate cancer due to a PSA > 4 ng/mL, a PSA density > 0.18 ng/mL/mL, a PSA velocity > 0.75 ng/mL/year or a pathological digital rectal examination. Exclusion criteria were patients with previous history of prostate biopsies, prostate surgery or radiotherapy. Patients undergoing medical treatment for benign prostate hyperplasia were also excluded. The MRI results did not influence the inclusion of patients as MRI examination was carried out after the patient was enrolled in the study. Between October 2014 and April 2016, 60 patients were prospectively enrolled.

MRI protocol

All patients underwent a 3T prostate MRI (Signa®, GE, Milwaukee, WI, USA) prior to the biopsy. An 8-channel surface coil without an endorectal coil was used. The MRI protocol included an axial T1-weighted sequence for the pelvis, an axial and sagittal T2-sequence centred on the prostate and an axial diffusion sequence using a b-value of 0 and 1400 s/mm^2, from which and apparent diffusion coefficient (ADC) map was created.

MRI analysis

PI-RADS v1 criteria [14] were used to evaluate prostate lesions, as PI-RADS v2 [15] was not yet available. Diffusion-weighted imaging (DWI) was used as the dominant sequence in the peripheral zone (PZ) and T2-weighted imaging in the transitional zone (TZ) [16]. Two radiologists evaluated the MRI studies, the first prior to the biopsy (with 2 years of experience in prostate MRI) and the second during the biopsy (with 5 years of experience). An MRI study was defined as positive, when a PI-RADS 4 or 5 lesion was present, this being the target lesion. If a PI-RADS 4 or 5 lesion was not present, defined as a negative MRI, a target lesion was regarded as the highest PI-RADS lesion (PI-RADS 2 or 3).

Biopsy protocol

A genitournary radiologist with 5 years of experience in MRI-TB carried out the transperineal biopsies. These were done in an outpatient setting, after prophylactic antibiotic treatment and with the patient in a lithotomy position. Lidocaine gel was applied in the anal ring 5 minutes before the placement of a dedicated ultrasound probe for transperineal biopsies (ERB H45202ER, GE Healthcare, Milwaukee, WI, USA). Local anaesthesia was released under ultrasound

Please cite this article in press as: Garcia Bennett J, et al. Evaluation of MR imaging-targeted biopsies of the prostate in biopsy-naïve patients. A single centre study. Diagnostic and Interventional Imaging (2017), http://dx.doi.org/10.1016/j.diii.2017.06.010