Short Communication

Multiparametric magnetic resonance imaging/transrectal ultrasound fusion-guided prostate biopsy: a comparison with systematic transrectal ultrasound-guided prostate biopsy

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INTRODUCTION

Prostate cancer (PCa) represents the tumor with the highest incidence in Italy and its incidence significantly increase with age. Physicians however tend to be reluctant to recommend serum prostate-specific antigen (PSA) testing in men > 75 years as well as to advise prostate biopsy for increased PSA levels; this is even more true for those with PSA in the grey zone (4-10 ng/ml) who suffer from lower urinary tract symptoms (LUTS). Such reluctance is likely associated to the perception of most PCas in the elderly being clinically insignificant. Multiparametric magnetic resonance imaging (mpMRI) of the prostate is increasingly been used in the assessment of patients at risk of being diagnosed with PCa.
given its postulated ability to identify such neoplasm, particularly high-grade disease 1.

The diagnosis of PCa however relies on prostate biopsy (PBx) but the diagnostic yield of Transrectal Ultrasound (TRUS) guided PBx remains low. In current clinical practice the cancer detection rate (CDR) of a first extended TRUS-guided systematic PBx prompted by an elevated PSA level and/or an abnormal digital rectal examination (DRE) is in the range of 40% 2, dropping to approximately 25% in the setting of screening programs, i.e. patients with serum PSA between 2.5 and 10 ng/mL 3. Efforts to improve the diagnostic yield of PBx have been oriented towards the construction of predictive models combining serum PSA and DRE findings with other readily available clinical information such as age, prostate volume (PVol), %freePSA etc., but also towards the development of novel tools including biomarkers 4 and imaging techniques. mpMRI findings seem to increase the accuracy of models predicting PBx outcome 5. Most important, the possibility of fusing mpMRI and TRUS images to guide PBx, the so-called fusion PBx, has been suggested to significantly increase significantly PBx CDR 6. The optimal clinical application of mpMRI, however, remains under investigation. According to current EAU guidelines 7, despite the use of the new PIRADS v2 scoring system, mpMRI has a low specificity, with high rates of false positives, especially among lesions scored 3/5 and 4/5. Moreover, the inter-reader reproducibility is moderate, limiting its broad use outside expert centres. Having said this, EAU guidelines recommend it before repeat biopsy (evidence level 1°; grade A). In the present study we evaluated our experience with mpMRI/TRUS fusion-guided PBx comparing its outcome with that of “standard” systematic TRUS guided PBx in the setting of both first and repeat PBx.

PATIENTS AND METHODS

Data of patients scheduled for TRUS-guided transrectal PBx because of increased serum PSA (≥ 4 ng/mL) and/or abnormal digital rectal examination (DRE) were prospectively entered into our dedicated Institutional Review Board-approved database. The present study is a retrospective comparison of the first 99 patients having undergone mpMRI/TRUS fusion-guided PBx (Group A) with a matched population of patients having undergone standard systematic TRUS-guided PBx (Group B). The percentage of patients aging > 75y was 20% in Group A and 17% in Group B. The overall CDR was 76% in Group A and 31.9% in Group B (p < 0.001) whereas the rate of complications rate (Group A 4% vs Group B 3%). The overall CDR was 60.6% in Group A and 29.2% in Group B (p < 0.001) whereas the rate of clinically-significant (csPCa), defined as cancers with Gleason sum ≥ 7 6, was 26.2% in Group A and 13.1% in Group B (p = 0.02). In the setting of first PBx, the overall CDR was 76% in Group A and 31.9% in Group B (p < 0.001) whereas the rate of csPCa was 34.7% in Group A and 18.6% in Group B (p = 0.08). In the setting of repeat PBx, the overall CDR was 47.1% in Group A and 26.9% in Group B (p = 0.032) whereas the rate of csPCa was 18.8% in Group A and 8.9% in Group B (p = 0.132). CDR correlated well with the Prostate Imaging-Reporting and Data System (PIRADS), being 50, 61.8 and 90% for PIRADS 3, 4 and 5 respectively in the overall population, specifically 84.6, 67.8 and 100% in the setting of first PBx, and 28.5, 55.5 and 80% in the setting of repeat PBx (Tab. III).

RESULTS

Table I reports the baseline characteristics of the 99 patients having undergone mpMRI/TRUS fusion-guided PBx (Group A) and those of a matched population of patients having undergone standard systematic TRUS-guided PBx (Group B). The overall CDR (Tab. I) was 60.6% in Group A and 29.2% in Group B (p < 0.001) whereas the rate of clinically-significant (csPCa), defined as cancers with Gleason sum ≥ 7 6, was 26.2% in Group A and 13.1% in Group B (p = 0.02). In the setting of first PBx, the overall CDR was 76% in Group A and 31.9% in Group B (p < 0.001) whereas the rate of csPCa was 34.7% in Group A and 18.6% in Group B (p = 0.08). In the setting of repeat PBx, the overall CDR was 47.1% in Group A and 26.9% in Group B (p = 0.032) whereas the rate of csPCa was 18.8% in Group A and 8.9% in Group B (p = 0.132). CDR correlated well with the Prostate Imaging-Reporting and Data System (PIRADS), being 50, 61.8 and 90% for PIRADS 3, 4 and 5 respectively in the overall population, specifically 84.6, 67.8 and 100% in the setting of first PBx, and 28.5, 55.5 and 80% in the setting of repeat PBx (Tab. III).
Complications were always minor. Macroscopic hematuria was observed in 2 (2%) cases and lasted 1-2 days. Rectal bleeding were also seen in 2 cases (2%). In one it required endoscopic clipping of a small artery, in the other Foley catheter balloon compression. There was one urinary tract infection which required specific antibiotic treatment. In 2 cases (2%) vasovagal symptoms as sweating, nausea, paleness, dizziness, and hypotension were observed. In all patients, these symptoms regressed when the patient was laid in the Trendelenburg position. Two patients (2%) suffered acute urinary retention treated by an indwelling Foley catheter for one week. All complications occurred in patients > 75y. Like for other procedures\textsuperscript{12}, the limited number of complications may be linked to our case volume.

**DISCUSSION**

The present study pointed out that mpMRI/TRUS fusion-guided PBx provided greater CDR than standard systematic PBx for overall PCa and csPCa in the setting of first and repeat PBx. Considering that this was our initial experience (first 99 cases) findings were quite satisfactory. Indeed, it has been reported that such results can be expected after having completed the learning curve of both radiologists and urologists with this procedure. Panebianco et al.\textsuperscript{13} reported a learning curve of approximately 50 cases whereas Canio et al.\textsuperscript{14} reported a learning curve of 270 cases. Furthermore, we recorded a very satisfactory correlation between PI-RADS scoring and CDR at PBx, somehow challenging the reported mpMRI low specificity and high rates of false positives between PIRADS 3 and 4 lesions\textsuperscript{15}. Back to mpMRI indications, EAU guidelines recommend mpMRI before repeat biopsy (evidence level 1\textsuperscript{st}; grade A) whereas its use in candidates for first PBx remains controversial. The initial and simplest method for mpMRI-targeted biopsy strategy is the cognitive approach. Three RCTs have compared a TRUS-guided

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### Table I. Patients descriptive characteristics.

<table>
<thead>
<tr>
<th></th>
<th>Group A = 99pts</th>
<th>Group B = 99 pts</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE (y)</td>
<td>65.6 (58.6 ± 72.6)</td>
<td>66.4 (64 ± 68.8)</td>
<td>0.4958*</td>
</tr>
<tr>
<td>PSA (ng/ml)</td>
<td>7.9 (4.9 ± 10.9)</td>
<td>7.3 (4.7 ± 9.9)</td>
<td>0.1558*</td>
</tr>
<tr>
<td>Suspicious DRE (%)</td>
<td>33.3 % (33/99)</td>
<td>33.3 % (33/99)</td>
<td>1*</td>
</tr>
<tr>
<td>Prostate Volume (mL)</td>
<td>56.4 (30.8 ± 82)</td>
<td>55.1 (32.7 ± 77.5)</td>
<td>0.4811*</td>
</tr>
<tr>
<td>Previous PBx (%)</td>
<td>52.5% (52/99)</td>
<td>52.5% (52/99)</td>
<td>1*</td>
</tr>
<tr>
<td>Previous Surgery for BPH (%)</td>
<td>3% (3/99)</td>
<td>3% (3/99)</td>
<td>1*</td>
</tr>
</tbody>
</table>

Group A: mpMRI/TRUS fusion guided PBx; Group B: standard TRUS guided PBx. Data are expressed as means ± standard deviations or percentages. *Student’s t-test; * Fisher’s exact test.

### Table II. Cancer detection rates.

<table>
<thead>
<tr>
<th></th>
<th>Group A = 99 pts</th>
<th>Group B = 99 pts</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Pca</td>
<td>60.6 % (60)</td>
<td>29.2 % (29)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>First PBx</td>
<td>76%</td>
<td>31.9%</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Repeat PBx</td>
<td>47.1%</td>
<td>26.9%</td>
<td>0.032</td>
</tr>
<tr>
<td>csPCa</td>
<td>26.2 % (26)</td>
<td>13.1 % (13)</td>
<td>0.02</td>
</tr>
<tr>
<td>First PBx</td>
<td>34.7% (16/46)</td>
<td>18.6% (8/43)</td>
<td>0.08</td>
</tr>
<tr>
<td>Repeat PBx</td>
<td>18.8%</td>
<td>8.9%</td>
<td>0.132</td>
</tr>
</tbody>
</table>

Group A vs Group B; chi-square test.

### Table III. Cancer detection rates by prostate imaging-reporting and data system (PIRADS) version 1 in patients having undergone mpMRI/TRUS fusion guided PBx.

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>First PBx</th>
<th>Repeat PBx</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIRADS 3 (%)</td>
<td>17/34 (50 %)</td>
<td>11/13 (84.6%)</td>
<td>6/21 (28.5%)</td>
<td>0.001</td>
</tr>
<tr>
<td>PIRADS 4</td>
<td>34/55 (61.8 %)</td>
<td>19/28 (67.8%)</td>
<td>15/27 (55.5%)</td>
<td>0.35</td>
</tr>
<tr>
<td>PIRADS 5</td>
<td>9/10 (90%)</td>
<td>5/5 (100%)</td>
<td>4/5 (80%)</td>
<td>0.29</td>
</tr>
<tr>
<td>Overall</td>
<td>60/99 (60.6 %)</td>
<td>35/46 (76%)</td>
<td>25/53 (47.1%)</td>
<td>0.001</td>
</tr>
</tbody>
</table>
12-core PBx with a cognitive mpMRI-guided PBx in the setting of first PBx yielding conflicting results. The first two studies pointed out that CDR was higher in the mpMRI-guided group, whereas the most recent one showed that the two procedures provided comparable results.

The mpMRI/TRUS fusion software has been developed with the aim of providing a more precise sampling of the lesions identified by mpMRI. Initial non-randomized studies comparing mpMRI/TRUS fusion PBx with “standard” TRUS-guided PBx in the setting of first PBx pointed out that fusion PBx provided better CDR than “standard” PBx, whereas the most recent one showed that the two procedures provided comparable results.

In conclusions, mpMRI/TRUS fusion-guided PBx provided greater CDR than standard TRUS-guided systematic PBx in the setting of first and repeat PBx. Increasing the CDR of PBx would significantly reduce the number of unnecessary PBxs with significant benefits in terms of costs and patient anxiety. On the other hand, one should take into account the risk of overdiagnosing low-risk PCa, with overtreatment possibly leading to procedure-related complications. Therefore, like for other common benign urological conditions, the final clinical decision has to rely on wise clinical judgment.

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CONFLICT OF INTEREST
The authors declare no conflict of interest.

References


