Multiparametric MRI-based dosimetric parameters best predict short term time course of PSA after Iodine 125 permanent prostate brachytherapy for localized prostate cancer.

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BACKGROUND
Dosimetric guidelines for Iodine 125 low dose brachytherapy for localized prostate cancer have been established taking into account the whole prostate gland (V100% > 95%, V150% ≤ 50% and D90% > 100%). High dose heterogeneity within the prostate leads to ‘unintended’ focal dose escalation. PSA bounce may occur after brachytherapy, but its mechanisms remain still unclear and could be correlated to a higher biochemical disease-free survival.

Endpoints of this study were:
1. To define if dose-volume parameters of the central gland, the peripheral zone and the dominant intra prostatic lesion (DIL) could best predict PSA bounce phenomenon.
2. To determine the relationship between dose-volume parameters with respect to the DIL when compared to the whole prostate and early biochemical outcome after permanent prostate implantation.

METHODS
• Between 2007 and 2011, 45 low-risk patients underwent a pretherapeutic multiparametric MRI at 3T, without endo-rectal coil before a permanent iodine seeds brachytherapy at the dose of 160Gy for localized prostate cancer as monotherapy.
• Prostate volumes were defined on pre-therapeutic T2-weighted MRI and DCE-MRI:
  - Whole prostate
  - Peripheral zone
  - Central zone
  - DIL
• A co-registration of each multimodal MR sequences with the dosimetric CT-scan at day 30 (after brachytherapy) allowed evaluation of D90%, V100%, V150% for each volume.
• Patients were seen with a PSA sampling at 1 month and every 6 months thereafter. A PSA bounce was defined as an increase ≥ 0.2 ng/mL followed by a spontaneous decrease.

RESULTS

![Figure 1: Mean volumes in cm3: for the whole prostate, peripheral zone, central zone and dominant intra-prostatic lesions as defined on MRI.](image1)

![Figure 2: PSA bounce incidence (increase ≥ 0.2 ng/mL followed by spontaneous decrease).](image2)

![Figure 3: Mean time for PSA bounce happening and mean duration, in months.](image3)

![Figure 6: Mean PSA value 4 months after brachytherapy for bounce and non bounce patients. * p=0.036](image6)

![Figure 7: Mean D90% in the dominant intra-prostatic lesion and PSA one year after brachytherapy. * p=0.009](image7)

Table 1: Multivariate logistic regression analysis for PSA bounce, patient age and V150% in the central zone.

<table>
<thead>
<tr>
<th>Multivariate logistic regression</th>
<th>Bounce/total</th>
<th>OR</th>
<th>IC 95%</th>
<th>P</th>
</tr>
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<tr>
<td>Age</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>&lt; 65 years</td>
<td>14/27</td>
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<td>0.087</td>
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<tr>
<td>≥ 65 years</td>
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<td>(0.006-1,210)</td>
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<tr>
<td>V150% Central zone ≤ 47cc</td>
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<td>0.003</td>
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<tr>
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<td>0.10</td>
<td>(0.020-0.460)</td>
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</tbody>
</table>

CONCLUSION
Our study shows that a high PSA value 4 months after brachytherapy is a predictor of PSA bounce while a low V150% in central prostatic zone is associated with PSA bounce whatever the age of patients.

A high dose delivered to the DIL is associated with a PSA≤ 1ng/mL one year after brachytherapy. In the literature, the slower the decrease in PSA value, the lower the PSA nadir after Iodine-125 brachytherapy. Our results suggest that PSA kinetic could be slower if the DIL is treated at very high dose.