The rationale behind this treatment strategy will be discussed. A radiotherapy dose-response relationship has been observed in prostate cancer, with higher doses achieving better local control and survival outcomes. However, despite better results, the increased dose results in greater rectal and urinary toxicity. Prostate cancer does not exist as a homogenous tumour distributed evenly through the prostate gland. The disease is often multi-focal and may possess varying biological characteristics. It is therefore likely that some regions of prostate tumours are more radio-resistant than other areas. The more resistant regions would require a higher dose to achieve the same tumour control probability. mpMRI techniques such as diffusion weighted imaging, dynamic contrast enhanced MRI, intrinsic susceptibility weighted MRI and spectroscopy can produce valid biomarkers for characteristics such as hypoxia, cellular proliferation, vascularity and clonogen density. The ability to incorporate this information into radiotherapy planning and to selectively increase the dose administered to these relatively resistant regions should achieve better tumour control without the degree of toxicity produced by whole gland dose escalation.

In addition, the technical challenges that focussed dose escalation poses to the operator and planning team will be explored in this talk. For example, the implantation process itself causes geometric deformation of the gland, making fusion of any pre-implantation image difficult and error-prone. Also, the implant itself may change the tumour micro-environment. A significant drop in blood flow, associated with an increase in tumour hypoxia may be caused by the trauma of needle insertion. The optimum dosimetric model to achieve dose escalation to the boost volume whilst maintaining a lower dose to the remaining gland by individualizing the needle positions will be discussed and early clinical evidence for focussed dose boosting using High Dose Rate brachytherapy will be presented.

SP-0227
Focal therapy alone in primary and recurrent disease
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Introduction: Focal radiotherapy treatment procedures play increasingly important role in function and organ preservation treatment techniques. Focal and differential radiotherapy already has an established role in partial organ treatments for other tumour sites, e.g., partial breast irradiation in low-risk breast cancer. An alternative to traditional whole gland treatments, focal radiotherapy may be of benefit for both primary tumour as well as locally recurrent disease.

Material and Methods: Review of the current literature on the topic including patient selection, preliminary toxicity and outcome data as well as a technical overview on treatment delivery techniques.

Results: Partial organ treatment in early prostate cancer is now technically feasible. To date only small and generally monoinstitutional series have been published. Early feasibility and toxicity data encouraging and demonstrate potential advantages for the role of focal brachytherapy.

Summary: Brachytherapy is the ideal choice for small volume partial organ treatments in low-risk prostate cancer. To date, only preliminary results are available (HDR/LDR) and no large cohort comparative results are published. Further prospective and comparative controlled investigations with larger cohorts are needed.

OC-0228
A differential dose prescription strategy in permanent low-dose-rate prostate brachytherapy
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Purpose/Objective: Outstanding long-term biochemical control rates and local tumor control rates have been reported after permanent low-dose-rate brachytherapy (LDR-BT) in low-risk prostate cancer patients. However, treatment-related side effects such as irritative and obstructive urethral symptoms have also been reported. We investigated in this study a differential target and dose prescription concept for prostate LDR-BT including a redistribution of dose according to risk of local failure and treatment related morbidty.

Materials and Methods: Our study included 15 consecutive prostate cancer patients treated with low-dose-rate brachytherapy (LDR-BT) using 125-Iodine seeds. Multi-parametric MRI sequences were acquired prior to LDR-BT for gross tumor volume (GTV) delineation. The prostate gland (CTV prostate) and organs at risk (OARs) were defined on transrectal US images, acquired during LDR-BT. The GTV structure was transferred to US images after MRI-US image registration. A high-risk target volume (CTVHR = GTV + 5 mm margin) was defined. The CTV prostate was treated as an intermediate-risk target volume. Two dose plans were made: Plan1 involved redistribution of dose with a de-escalated dose of minimum 125 Gy to CTV prostate and a dose escalation to 250 Gy to CTV HR, if consistent with OAR constraints; Plan2 involved the standard clinical dose of minimum 145 Gy to CTV prostate. DVH parameters were converted to equivalent dose in 2 Gy fractions (EQD2) for targets and OARs.

Results: Dose redistribution Plan1 resulted in an increased GTV-D90 by a median of 40 Gy (range, 2 - 130 Gy) and an increased CTV prostate-D90 by a median of 15 Gy (range, 1 - 68 Gy) as compared to standard clinical planning (Plan2) (p<0.001) (Figure 1). The urethral D10 and D30 decreased by a median of 13 Gy (range, -1 - 43 Gy) and 14 Gy (range, 6 - 36 Gy), respectively while the bladder neck D10 and D30 decreased by a median of 25 Gy (range, 1 - 39 Gy) and 21 Gy (range, 5 - 32 Gy), respectively (p<0.001). The rectal D2.0cm3 had a median decrease of 6 Gy (ranging from a 13 Gy decrease to a 1 Gy increase) (p<0.001), while the rectal D0.1cm3 had a median increase of 2 Gy (ranging from a 46 Gy decrease to a 32 Gy increase) (p=0.45).
Conclusions: A differential target and dose prescription strategy was technically feasible with LDR-BT seed planning and resulted in a significant dose reduction to both urethra and bladder neck, as compared to standard clinical dose planning.

OC-0229
Focal salvage HDR brachytherapy for prostate cancer recurrence after primary external radiotherapy
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Purpose/Objective: Focal brachytherapy (BT) is investigated as an alternative to whole gland BT for salvage treatment of recurrent prostate cancer to potentially improve functional outcome while maintaining cancer control. The aim of this study was to evaluate feasibility and toxicity of such treatment using high-dose-rate (HDR) brachytherapy.

Materials and Methods: Seventeen patients were included in this prospective pilot study from May 2012 to July 2014. All the patients had received primary external beam radiotherapy with total dose of 70-78 Gy and experienced biochemical failure according to Phoenix criteria. Inclusion criteria were PSA <10 at inclusion, no detectable metastases on FACBC-PET-CT or pelvic MRI and a visible relapse tumour on FACBC-PET-CT or multiparametric MRI. All patients performed a bone marrow aspiration to assess the presence of micrometastatic disease in bone marrow. The salvage BT was delivered in 3 fractions with planning aim of 10 Gy to the tumour volume. For each fraction, separated by two weeks, the needles were applied using transrectal ultrasound (US) guidance. Gross tumour volume (GTV) was delineated in the US images based on pre-treatment MR and FACBC-PET-CT imaging. The urethra and the rectum wall were also delineated. Intra-operative treatment planning optimisation was performed for each fraction. Dose-volume-histogram parameters were found and 2Gy-equivalent (EQD2) total dose were calculated using the LQ-model. The toxicity was scored using the EORTC/RTOG scale.

Results: The median age of the patients was 69 years (range: 60-75). Table 1 summarises the key dosimetry parameters achieved for this study. The GTV was in average 24% the whole prostate gland (range: 6-56). For all the patients the GTV D90 was above the total planning aim of 78 Gy (EQD2, α/β = 3).

Table 1. Average, standard deviation (SD) and range for the key dosimetry parameters.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Average</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of needles</td>
<td>9</td>
<td>2.3</td>
<td>6-14</td>
</tr>
<tr>
<td>GTV volume [cm³]</td>
<td>5.7</td>
<td>2.1</td>
<td>1.5-10.6</td>
</tr>
<tr>
<td>V100 (%)</td>
<td>94.2</td>
<td>3.2</td>
<td>86.7-99.4</td>
</tr>
<tr>
<td>V250 (%)</td>
<td>14.4</td>
<td>9.3</td>
<td>2.2-44.5</td>
</tr>
<tr>
<td>Total GTV D90 [EQD2, α/β = 3]</td>
<td>88.9</td>
<td>11.0</td>
<td>78.7-110.0</td>
</tr>
<tr>
<td>Total Rectum D2 cm³ [EQD2, α/β = 3]</td>
<td>13.5</td>
<td>5.6</td>
<td>3.7-23.9</td>
</tr>
<tr>
<td>Total Urethra D0.1 cm³ [EQD2, α/β = 3]</td>
<td>25.0</td>
<td>6.5</td>
<td>10.7-34.2</td>
</tr>
</tbody>
</table>

There were a significant correlation between the number of needles used and the volume of the GTV (R² = 0.39, p<0.001). However, no correlation was found between the number of needles and the GTV D90, or between the volume of the GTV and the GTV D90.

The median follow-up was 9 months (range: 3-21). Three patients (16%) experienced grade 2 genitourinary (GU) or gastrointestinal (GI) symptoms (GU urge, pollakisuria and urine leakage). Only one patient reported grade 3 pollikasuria. In Figure 1 the GU and GI toxicity grades are plotted against the total EQD2 dose for rectum D2cm³ and urethra D0.1cm³.

Conclusions: Our results suggest that focal HDR salvage brachytherapy is feasible with a GTV D90 above the planning aim for all the patients. The toxicity was acceptable; however, longer follow up is needed.

Poster Discussion: Intrafraction and interfraction management

PD-0230
Quantifying the impact of respiratory parameters in the spot scanning proton dose delivery
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Purpose/Objective: Respiratory motion cause significant dose errors in IMPT for lung cancer patients due to induced variations in range and the interplay effect. The aim of this study was to investigate the relation between the respiratory amplitude and the dose errors due to the these effects.

Materials and Methods: Intensity-modulated proton therapy (IMPT) plans with co-planar beam directions perpendicular to