Elekta

Case study

Elekta Unity facilitates hypofractionated, fiducial-free SBRT treatment of prostate cancer

Institution

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Why MRgRT for prostate?

MR-guided radiotherapy can offer improved anatomical definition compared to on-board CBCT, while reducing radiation exposure.

Live MR imaging during dose delivery is able to take into account not only the variability of prostate swelling, but also anatomical changes, such as inter/intra-fraction bladder and rectal filling, as well as independent changes to Organs At Risk (OAR).

The ability to perform daily adaptive re-planning could be the most interesting benefit in prostate cancer RT. With conventional Image Guided Radiation Therapy (IGRT), these are less accurate in compensating for the independent movements of the prostate volume.

Patient details

73-year-old patient with intermediate (favorable) risk prostate cancer (iPSA 6.56 ng/mL, Gleason score 3+4, no evidence of extracapsular disease at staging with pelvic RMN and Choline PET/CT).

An SBRT schedule of five fractions was proposed, which offered the patient the opportunity to be treated on the Elekta Unity MR-Linac. The current standard of care for SBRT to prostate is image-guided RT (IGRT) with Cone Beam CT (CBCT) and Volumetric Arc Therapy (VMAT) delivery on a conventional linac.

Why Elekta Unity?

The superior image quality of MR imaging (Image 1) before and live during treatment enabled real-time visualization of the tumor without the need for implanted fiducial markers, as well as visualization of the surrounding organs-at-risk (OAR).

Thanks to the ability to daily adapt the plan based on the size, shape and position of the anatomy (Image 2) evaluated in real time during each session (see the change in bladder shape over the course of treatment in the images below), the clinical team at IRCCS were able to reduce margins and limit the dose to the surrounding OAR (bladder, rectum and urethra).

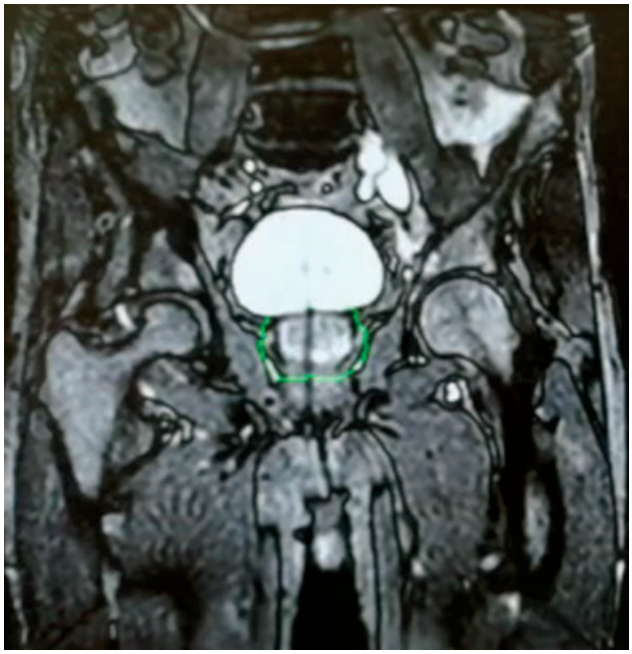

Image 1: Shows the exceptional image quality of the cine imaging

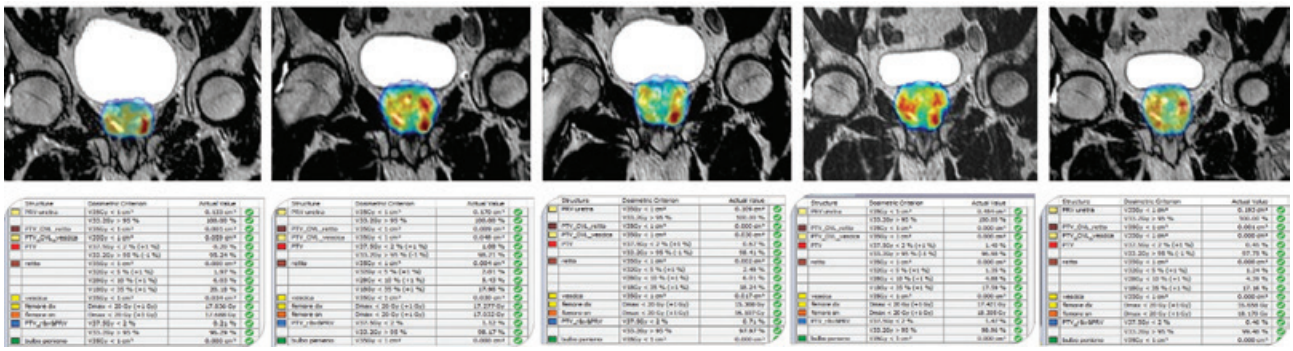

Image 2: The anatomy changes from fraction to fraction, highlighting the critical importance of Adapt to Shape daily plan adaptation, especially for these high-dose SBRT cases. All of the green ticks for each fraction demonstrate the robustness of the mBeam plan when adapted.

Three features, Adapt to Shape, Adapt to Size and Adapt to Position, enabled the safe and easy delivery of a radically reduced treatment (hypofractionation) compared to the more conventional fractionation scheme of 60 Gy in 20 fractions or 78 Gy in 39 fractions (Image 3). A shorter fractionation scheme increased patient compliance, without the patient having to spend five weeks visiting the hospital every day for treatment. This also offers the hospital improved patient throughput.

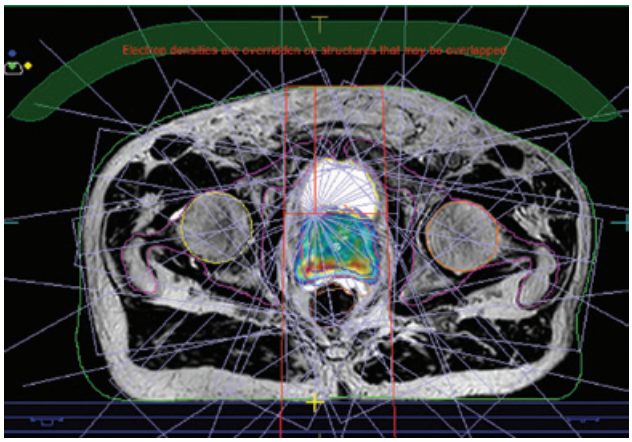

Image 3: The mBeam plan is equivalent in plan quality to a VMAT plan. Note: as part of the treatment for this patient, clinicians created VMAT and mBeam plans; both plans were equivalent.

Treatment Details

- 36.25 Gy in 5 fractions
- Online deformable plan adaptation for every treatment session
- Continuous, live motion monitoring during beam delivery

Results

- At the end of the treatment, no acute side effects were reported.
- After five months, the PSA decreased to 1.09ng/mL (nadir), without late signs and/or symptoms related to the SBRT treatment.

Be future proof for tomorrow

MRgRT opens up new prospects for RT in prostate cancer by enabling adaptive and on-line motion strategies, especially when extremely high doses per fraction are prescribed. Unity's capability to produce high-field MR sequences during and after the treatment could also open unexplored windows on the landscape of radiomics and treatment response for prostate cancer RT.

As a leader in precision radiation therapy, Elekta is committed to ensuring every patient has access to the best cancer care possible.

We openly collaborate with customers to advance sustainable, outcome-driven and cost-efficient solutions to meet evolving patient needs, improve lives and bring hope to everyone dealing with cancer.

To us, it's personal, and our global team of 4,700 employees combine passion, science, and imagination to profoundly change cancer care.

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Disclaimer

This publication is based on the experience and application of a medical expert, and is intended as an illustration of an innovative use of Elekta solutions. It is not intended to promote or exclude any particular treatment approach to the management of a condition. Any such approach should be determined by a qualified medical practitioner. It is important to note that radiation treatments, while usually beneficial, may cause side effects that vary depending on the clinical site being treated along with other medical circumstances. The most frequent side effects are typically temporary and may include, but are not limited to, skin redness and irritation, hair loss, respiratory, digestive, urinary or reproductive system irritation, rib, bone, joint or soft tissue (muscle) pain, fatigue, nausea and vomiting. In some patients, these side effects may be severe. Treatment sessions may also vary in frequency, complexity and duration. Finally, radiation treatments are not appropriate for all cancers, and their use along with the potential benefits and risks should be discussed before treatment.