Case study

Single kidney patient turned down for therapy has treatment on Elekta Unity

Institution
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Location
Italy

Medical staff
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**Treat moving targets** and spare healthy tissue with confidence and certainty

**Oligometastases and SBRT**
Oligometastatic cancer is a disease defined as a state of limited metastases for which the addition of ablative therapies could increase the chances of cure, including such treatments as SBRT and surgery. In the absence of randomised phase 3 trials, early clinical studies show improved survival when radical local therapy is added to standard systemic therapy for oligometastatic disease.¹

**Why MRgRT?**
Magnetic Resonance guided Radiation Therapy (MRgRT) can provide advantages over conventional radiation therapy treatment methods for most abdominal lesions, with superior visualization of mobile structures such as stomach, duodenum, liver and kidneys. The possibility to adapt the dose to the daily anatomical situation, increases the chance to deliver a local ablative treatment.

**Patient Details**
A 48-year old male with a single kidney was diagnosed with primary kidney cancer and synchronous surrenal oligometastases. Because of the clinical complexity of his case associated with the high-risk of causing permanent radiation-induced damage to his single kidney, and the potential to then render him renal dialysis dependent, the clinical team sought to obtain Radiation Therapy using particle therapy (because of the steep dose gradient), but were turned down.

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¹ Why MRgRT?

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**Why Elekta Unity?**

The team at the Sacro Cuore-Don Calabria Advanced Radiation Oncology Department in Negrar Verona were able to provide the patient with localized SBRT treatment to the surrenal lesion whilst precisely achieving dose constraints to the kidney and liver.

Elekta Unity enables unparalleled acquisition of diagnostic quality MR (1.5T) images before and in real-time during the treatment itself. In this case, superior soft tissue contrast (compared to CBCT-based RT), enabled direct visualization of the surrenal lesion and surrounding anatomy, allowing for daily online deformable adaptive strategies to improve lesion coverage, while avoiding nearby critical structures, including this patient’s solitary kidney.

The combination of imaging with online deformable plan adaptation and stereotactic treatment delivery capabilities meant the team could confidently deliver a high and precise dose, in this high-risk case.

Treatment planning for Unity is achieved with simple application of templates that contain mainly anatomical structures, avoiding the complex and tedious task of creating help structures. This includes functionality that ensures the dose to organs at risk are as low as possible, whilst maintaining target coverage. Parameters promote robustness and treatment efficiency meaning that, stereotactic treatment delivery with 10 IMRT beams can still be delivered fast.

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**Exceptional image quality of cine imaging**

**Surrenal Metastasis PTV**

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<tbody>
<tr>
<td>Volume (% of the PTV covered by 38.10 GY)</td>
<td>GOOD</td>
<td>GOOD</td>
<td>0.791</td>
<td>ACCEPTABLE</td>
<td>2.73</td>
<td>GOOD</td>
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<tr>
<td>Volume (% of the PTV covered by 44.20 GY)</td>
<td>GOOD</td>
<td>GOOD</td>
<td>0.554</td>
<td>ACCEPTABLE</td>
<td>94.879</td>
<td>GOOD</td>
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<tr>
<td>Dose (Gy) covering 100% (cc) of the Kidney RT</td>
<td>PASS</td>
<td>PASS</td>
<td>11.501</td>
<td>PASS</td>
<td>9.571</td>
<td>PASS</td>
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<tr>
<td>Mean dose (Gy) to the Kidney RT</td>
<td>PASS</td>
<td>PASS</td>
<td>0.689</td>
<td>PASS</td>
<td>0.689</td>
<td>PASS</td>
</tr>
<tr>
<td>Mean dose (Gy) to the Liver</td>
<td>PASS</td>
<td>GOOD</td>
<td>4.115</td>
<td>GOOD</td>
<td>4.650</td>
<td>GOOD</td>
</tr>
<tr>
<td>Dose (Gy) covering 100% (cc) of the DUODENUM</td>
<td>PASS</td>
<td>GOOD</td>
<td>10.647</td>
<td>PASS</td>
<td>11.501</td>
<td>PASS</td>
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<tr>
<td>Mean dose (Gy) to the DUODENUM</td>
<td>GOOD</td>
<td>1.226</td>
<td>ACCEPTABLE</td>
<td>4.584</td>
<td>GOOD</td>
<td>1.179</td>
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<tr>
<td>Dose (Gy) covering 30.00% (cc) of the STOMACH</td>
<td>PASS</td>
<td>GOOD</td>
<td>5.915</td>
<td>PASS</td>
<td>6.169</td>
<td>PASS</td>
</tr>
<tr>
<td>Mean dose (Gy) to the STOMACH</td>
<td>GOOD</td>
<td>1.050</td>
<td>GOOD</td>
<td>0.809</td>
<td>GOOD</td>
<td>1.015</td>
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<tr>
<td>Dose (Gy) covering 0% (cc) of the Spinal Cord</td>
<td>GOOD</td>
<td>6.727</td>
<td>GOOD</td>
<td>8.566</td>
<td>ACCEPTABLE</td>
<td>10.722</td>
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All dosimetric criteria were met and within constraints for the entire treatment.
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Treatment Details

- Patient treatment deemed not possible by other centers due to clinical complexity
- 36 Gy in 6 fractions with 10 beams SBRT
- Daily online deformable adaptive workflow for MRgRT
- Only One Kidney: D1cc <15Gy
- Liver: Dmean <5Gy
- MR Treatment sequence: T2 3D Navigated (Navigated can correct for any motion that occurs during image acquisition)
- Continuous motion monitoring of PTV
- Total treatment time 39 minutes

Results

After the treatment, the patient reported zero radiation therapy-related toxicity.

Stereotactic Approach of planning – Automated MCO in stage 1 and Manual Weight Optimization in stage 2
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.

We don’t just build technology, we build hope.

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Hope for everyone dealing with cancer.

References