THE ROLE OF IMAGING AND BIOPSY AFTER ABLATIVE THERAPY FOR SMALL RENAL TUMORS

Andrea Cestari
San Raffaele Turro Hospital
Vita-Salute San Raffaele University
Milano
Prof. Giampiero Cardone
Dept of Urology - Vita Salute University
San Raffaele Hospital - Milan
MINIMALLY INVASIVE AND ROBOTIC TEAM MEMBERS:

GIORGIO GUAZZONI (Chief)
ANDREA CESTARI (Coordinator)

NICOLO’ BUFFI
FABIO FABBRI
GIOVANNI LUGHEZZANI
MATTIA SANGALLI
EMANUELE SCAPATICCI
MATTEO ZANONI
Editorial – referring to the article published on pp. 1204–1209 of this issue

How Should Small Renal Masses Be Treated Today?

Andrea Cestari a,*, Richard Naspro b, Giorgio Guazzoni a

aDepartment of Urology, Vita-Salute University, San Raffaele Hospital, Turro, Milan, Italy
bDepartment of Urology, Humanitas Gavazzeni Hospital, Bergamo, Italy
## 6. TREATMENT OF LOCALISED RCC

### 6.1 Nephron-sparing surgery (partial tumour resection)

Nephron-sparing surgery (partial tumour resection) for localised RCC has a similar oncological outcome to that of radical surgery (1-5). However, in some patients with localised RCC, nephron-sparing surgery is not suitable because of:

- locally advanced tumour growth;
- partial resection is not technically feasible because the tumour is in an unfavourable location;
- significant deterioration of a patient’s general health.

### 6.1.5 Recommendations

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>GR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical therapy is the only curative therapeutic approach for the treatment of RCC. For T1 tumours, <strong>nephron-sparing surgery should be performed whenever possible</strong>. Extended lymphadenectomy does not improve survival and can be restricted to staging purposes.</td>
<td>A</td>
</tr>
<tr>
<td>Adrenalectomy (together with nephrectomy) is not needed in most patients, except when there is a large upper pole tumour and direct invasion of the adrenal gland is likely or when a normal adrenal gland cannot be excluded.</td>
<td>B</td>
</tr>
<tr>
<td>Embolisation can be a beneficial palliative approach in patients unfit for surgery and suffering from massive haematuria or flank pain.</td>
<td>C</td>
</tr>
</tbody>
</table>
TREATMENT OF SMALL RENAL MASSES
Multiple options

- Open Partial Nephrectomy
- Laparoscopic/Robotic Partial Nephrectomy
- Focal Therapy (Cryoablation)
FOCAL THERAPY

Open issues

Oncological follow up:

• Histology

• Radiology (imaging)
RENAL FOCAL THERAPY
Oncological follow up
HYSTORICAL FOLLOW UP PROTOCOLS

I. Gill et al.  
RMN 24 HOURS  
RMN 1 - 3 MONTHS  
RMN 6 MONTHS + BIOPSIES  
RMN 12 MONTH  
A. Cestari et al.

Biopsy repetition in case of enlarging masses or persisting enhancement
HISTORICAL FOLLOW UP PROTOCOLS

<table>
<thead>
<tr>
<th></th>
<th>24h</th>
<th>1m</th>
<th>6m</th>
<th>12m</th>
<th>24m</th>
<th>36m</th>
<th>48m</th>
<th>60m</th>
<th>84m</th>
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<tbody>
<tr>
<td>TSE T2w</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
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<tr>
<td>ce FS GRE T1w</td>
<td><img src="image10.png" alt="Image" /></td>
<td><img src="image11.png" alt="Image" /></td>
<td><img src="image12.png" alt="Image" /></td>
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<td><img src="image18.png" alt="Image" /></td>
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<tr>
<td>subtracted ce FS GRE T1w</td>
<td><img src="image19.png" alt="Image" /></td>
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<tr>
<td>TSE T2w</td>
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<td><img src="image35.png" alt="Image" /></td>
<td><img src="image36.png" alt="Image" /></td>
</tr>
</tbody>
</table>

A. Cestari et al.
IMAGING
WHAT INFORMATION DO WE NEED?

EVALUATION OF TREATED AREA

24 h check:
• proper coverage of lesion
• devascularization
• bleeding

Subsequent checks:
• progressive reduction in size
• persistent devascularization
• percutaneous biopsies guidance (?)
WHAT INFORMATION DO WE NEED?

• Evaluation and monitoring of complications
• Recurrences
• New lesions
IMAGING

WHAT INFORMATION DO WE NEED?

THE GREAT QUESTION:

CT scan vs MRI

????
IMAGING

WHAT INFORMATION DO WE NEED?

LESSON LEARNED

Thanks to Prof. Cardone!!!!
Postoperative ce MR/CT images showed complete ischemia of the cryolesions, with relative hypovascularization compared to normal renal parenchyma.

Early postprocedural (24 hrs) CT and MR images showed incomplete ischemia of cryolesions in 10% of the cases, with small intralesional enhancement, disappeared in the subsequent imaging controls.

The better evaluation of the lack of enhancement of the treated areas was obtained with subtracted ce FS GRE T1w images. Completely treated tumors appeared totally dark on MR subtraction images.
RESULTS (SIZE AND VASCULARIZATION)

FIG. 2 (67-years-old man who underwent left renal cryoablation for renal cell carcinoma)

On MR images, cryolesion was more than 1 cm larger than the original mass 24 hrs after treatment and showed progressive decrease in size at 1, 6, 12, 18, 24, 36, 48, 60 and 96 months. The criolesion showed no significant vascularization on conventional and subtracted ce-FS-GRE T1w images at 24hrs and 1, 6, 12, 18, 24, 36, 48, 60 and 96 months after surgery.

LAPAROSCOPIC CRYOABLATION OF RENAL CARCINOMAS: MEDIUM TERM OUTCOME AFTER 8yrs CT AND MR IMAGING FOLLOW-UP
FIG. 3 (62-year-old man who underwent right renal cryoablation for renal cell carcinoma)

After surgery CT imaging follow-up showed isodensity of the cryolesion on unenhanced CT images and hypodensity respect to renal parenchima on ce CT images, without contrast enhancement. Cryolesion was isodense compared to perilesional effusion. Cryolesion was more than 1 cm larger than the original mass 24 hrs after treatment and showed progressive decrease in size at 1, 6, 12, 18, 24, 36, 48 and 60 months.
FIG. 4 (64-years-old man who underwent left renal cryoablation for renal cell carcinoma)
MR images showed incomplete ischemia of cryolesion with small intraleisonal enhancement 24 hrs after surgery, particularly on subtracted ce-FS-GRE T1w images (arrow), which disappeared at 1 month after treatment.
FIG. 6 (67-years-old man who underwent left renal cryoablation for renal cell carcinoma, after right nephrectomy)
MR images showed incomplete ischemia of cryolesion with small intralesional enhancement 24 hrs after surgery (arrow), which disappeared at 1 month after treatment. Local recurrence at 12 months MR follow-up (arrow).
RESULTS (Local recurrence/Metachronous nodules)

FIG. 7 (62-year-old woman who underwent renal cryoablation for 2 papillary renal carcinomas of the left kidney)
Cryolesion on the lateral margin of the left kidney showed low signal intensity on TSE T2w images and progressive reduction in size at 12, 24, 36 and 48 months after surgery (red arrows). Cryolesion on the upper pole of the kidney (white arrow) showed a local recurrence at 24 month follow-up (green arrow), re-treated with cryotherapy (yellow arrow). TSE T2w MR images showed 3 metachronous nodules at 48 month follow-up (black arrows)
RESULTS (Metachronous nodules)

**FIG. 8** (61-year-old woman. 2 papillary renal carcinomas of the lower pole of the left kidney (yellow arrows) treated with cryoablation. On MR images, cryolesions were more than 1 cm larger than the original mass 24 hrs after treatment and showed progressive decrease in size at 1, 12, 24, and 48 month follow-up. The criolesions showed no significant vascularization on ce-FS-GRE T1w images (white arrows). One metachronous nodule in the treated kidney on coronal and axial ce-FS-GRE T1w MR images (red arrows) 48 months after treatment.
FIG. 9 (69-years-old man who underwent left renal cryoablation for renal cell carcinoma)

Early postprocedural FS-GRE T1w MR images showed hyperintense foci within the cryolesion (red arrows), due to small intralesional haematomas which afterwards reabsorbed in the following months.
FIG. 10 (77-years-old man who underwent left renal cryoablation for renal cell carcinoma) MR images showed perilesional haematoma at 1 and 3 months after surgery (red arrows), probably due to blood clot dissolution.
RESULTS (POSTOPERATIVE COMPLICATIONS)

FIG. 11 (77-years-old man who underwent right renal cryoablation for renal cell carcinoma)
MR images showed perilesional haematoma at 24 hrs, 1 and 3 months after surgery (red arrows), involving the surrounding soft tissues (white arrows), which disappeared at 6 months, after percutaneous drainage.
MR imaging allowed an optimal evaluation of cryolesions. In the early controls (1 month) MDCT images showed isodensity of the cryolesions compared to the surrounding perilesional effusion.

Subtraction (MR) or quantitative assessment using ROIs (CT) must be used to evaluate contrast enhancement of the treated areas. MR images showed a better evaluation of renal cryolesion vascularization, in particular in evaluation of the lack of enhancement of the treated areas on subtracted ce-GRE-FS-T1w images.
LAPAROSCOPIC CRYOABLATION OF RENAL CARCINOMAS: MEDIUM TERM OUTCOME AFTER 8yrs CT AND MR IMAGING FOLLOW-UP

RESULTS (COMPARISON BETWEEN CT AND MR IMAGING)

FIG. 12 (67-year-old man who underwent left renal cryoablation for renal cell carcinoma)
Good evaluation of morphology and decrease in size of the cryolesion both on MR and CT images at 6, 12, 18 and 24 months after surgery. Lack of vascularization of the treated area was better evaluated on subtracted ce-GRE-FS-T1w MR images.
FIG. 13 (51-year-old man who underwent left renal cryoablation for renal cell carcinoma)  
On MR images optimal evaluation of cryolesion and perilesional effusion on T2w images at one month after surgery. Perilesional effusion disappeared 12 months after treatment. Isodensity of the cryolesion compared to the surrounding perilesional effusion on CT images one month after surgery. Lack of vascularization of the treated area was better evaluated on subtracted ce-GRE-FS-T1w MR images.
Mechanism of cryoablation involves a direct cellular damage, an extracellular damage and a microvascular damage. The histologic sequelae of these processes are interstitial haemorrhage followed by minimal inflammatory reaction, coagulative necrosis with vascular congestion and pyknosis and finally fibrosis and scarring.

Since it is not possible to document histopathologically the complete tissue necrosis after cryoablation, an adequate radiological follow-up is mandatory. MRI represents the ideal since it is reproducible, limited operator dependent and optimally able to detect the difference between necrotic and still viable tissue. However CT, also for multiplanar reformatting capability, can be used as alternative choice to MR in the evaluation of small renal masses treated with laparoscopic cryoablation in patients with either relative or absolute contraindications to MR imaging.
DISCUSSION

In the MR imaging follow-up, cryolesions typically appear to be isointense on T1w images and hypo- or isointense on T2w images without any enhancement after gadolinium infusion and tend to reduce in size over time during the follow-up.

In the CT imaging follow-up, cryolesions typically appear to be heterogeneously iso-hypodense compared to renal parenchima, with relative hypodensity without any enhancement after contrast medium infusion and tend to reduce in size over time during the follow-up.

In our study, both MR and CT imaging allowed a good evaluation of size and morphology of the renal cryolesions, in particular using ce images, but MR showed better contrast resolution, in particular on unenhanced images and in delineating cryolesions compared to perilesional collections in the early controls. MR and CT imaging allowed a good evaluation of vascularization patterns, but MR imaging allowed superior confidence in the qualitative enhancement evaluation using subtracted ce-FS-GRE T1w MR images.
MR and CT are effective imaging techniques in the follow-up of renal lesions treated with LC.
To our knowledge, no systematic comparison of MR imaging with CT has been made to determine their relative accuracy at follow-up, and we currently consider the two imaging modalities to be diagnostically equivalent. MR imaging may be better suited for patients who have undergone MR imaging–guided ablation. In such patients, intraprocedural MR images can be directly compared with follow-up MR images, which helps to better understand and interpret findings.
THE ACTUAL ROLE OF
(IMAGING GUIDED)
POST OPERATIVE BIOPSIES
HISTOLOGICAL EXAMINATION

COMPLETE RCC ABLATION – Bx & RADIOL. FU
3027/07  Frozen section, before treatment
3046/07  Paraffin section, after treatment

FOCAL THERAPY = COAGULATIVE NECROSIS
RESULTS

Renal Cancer

Oncologic Results of Laparoscopic Renal Cryoablation for Clinical T1a Tumors: 8 Years of Experience in a Single Institution

Giorgio Guazzoni, Andrea Cestari, Nicolòmario Buffi, Giovanni Lughezzani, Luciano Nava, Gianpiero Cardone, Giuseppe Balconi, Massimo Lazzeri, Francesco Montorsi, and Patrizio Rigatti

A total of 131 SRMs in 123 patients (91 men and 32 women) were treated from September 2000 to June 2008. The mean tumor size was 2.14 ± 0.86 cm (range 0.5-4). Biopsy cores from the 123 patients revealed clear cell renal cell carcinoma (RCC) in 69 patients (56.1%), papillary RCC in 8 (6.53%), chromophobe RCC in 3 (2.4%), mucinous, tubular, and spindle RCC in 1 (0.8%), oncocytoma in 27 (21.9%), angiomyolipoma in 5 (4.1%), and xanthogranulomatous pyelonephritis in 1 patient (0.8%). The biopsy findings were nondiagnostic (fibrotic/necrotic tissue) in 9 cases (7.3%). The mean follow-up was 46.04 ± 25.75 months (median 41, range 12-96). In 44 patients with RCC and a mean follow-up of 61.3 ± 13.76 months, the cancer-specific survival rate was 100% and the overall survival rate was 93.2%. None of the 53 patients (RCC plus those with nonmalignant lesions) who had follow-up >5 years developed radiographic recurrence.
RESULTS

FIG. 1. A flow chart showing the number of lesions (N), percentage size reduction and enhancement pattern of the 26 cryolesions. For explanatory text see ‘Results.’ *The size reduction was calculated as a percentage of the size of the cryolesion 3 months after cryosurgery; nri, anonyoma; na, non-diagnostic tissue; no, no biopsy taken.

<table>
<thead>
<tr>
<th>Time</th>
<th>Mean lesion size, cm</th>
<th>Mean % size reduction</th>
<th>Lesions</th>
<th>Enhancements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>26</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.4 (1.3–3.8)</td>
<td>NA</td>
<td>1</td>
<td>Rim enhancement</td>
</tr>
<tr>
<td>3 months</td>
<td>2.7 (1.4–4.2)</td>
<td>NA</td>
<td>21</td>
<td>Rim enhancement</td>
</tr>
<tr>
<td>6 months</td>
<td>1.9 (0–2.7)</td>
<td>23</td>
<td>23</td>
<td>Rim enhancement</td>
</tr>
<tr>
<td>9 months</td>
<td>1.8 (0–2.4)</td>
<td>35</td>
<td>19</td>
<td>Only 1 mm² of enhancement in centre of cryolesion</td>
</tr>
<tr>
<td>12 months</td>
<td>1.5 (0–2.2)</td>
<td>38</td>
<td>14</td>
<td>Central area of 1 mm² of enhancement</td>
</tr>
<tr>
<td>18 months</td>
<td>1.3 (0–1.8)</td>
<td>42</td>
<td>9</td>
<td>No enhancement</td>
</tr>
<tr>
<td>24 months</td>
<td>1.2 (0–1.6)</td>
<td>44</td>
<td>5</td>
<td>No enhancement</td>
</tr>
<tr>
<td>30 months</td>
<td>1.6</td>
<td>NA</td>
<td>1</td>
<td>No enhancement</td>
</tr>
<tr>
<td>36 months</td>
<td>1.4</td>
<td>NA</td>
<td>1</td>
<td>No enhancement</td>
</tr>
</tbody>
</table>

Follow-up of renal masses after cryosurgery using computed tomography: enhancement patterns and cryolesion size

Patricia Beemster, Soffire Phoo*, Messel Wijkstra, Jean de la Rosette and Pilar Laguna
Departments of Urology and Radiology, Academic Medical Center, University of Amsterdam, the Netherlands
**RESULTS**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Tumours, n</th>
<th>Follow-up months</th>
<th>Imaging technique</th>
<th>Reference lesion*</th>
<th>Size measurement</th>
<th>% size reduction † 6/12 months</th>
<th>Recalculated % size reduction † 6/12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remer et al. [7]</td>
<td>20</td>
<td>12</td>
<td>MRI</td>
<td>1 day</td>
<td>volume</td>
<td>84/94</td>
<td>-/-</td>
</tr>
<tr>
<td>Gill et al. [13]</td>
<td>60</td>
<td>36</td>
<td>MRI</td>
<td>1 day</td>
<td>max. diameter</td>
<td>39/56</td>
<td>12/39</td>
</tr>
<tr>
<td>Cestari et al. [11]</td>
<td>37</td>
<td>36</td>
<td>MRI</td>
<td>1 day</td>
<td>max. diameter</td>
<td>59/73</td>
<td>30/55</td>
</tr>
<tr>
<td>Weld et al. [12]</td>
<td>36</td>
<td>36</td>
<td>CT/MRI</td>
<td>Pre-cryo</td>
<td>max. diameter</td>
<td>0/19</td>
<td>12/29</td>
</tr>
</tbody>
</table>

*The (cryo)lesion used to compare with the other cryolesions and calculate the % size reduction; †the percentage reduction in cryoablation size after 6 and 12 months vs the reference lesion. †the percentage reduction using the cryolesion size at 3 months after cryosurgery as the reference lesion.

Follow-up of renal masses after cryosurgery using computed tomography: enhancement patterns and cryolesion size
Patricia Beemster, Saffire Phoa*, Hessel Wijkstra, Jean de la Rosette and Pilar Laguna
Departments of Urology and *Radiology, Academic Medical Center, University of Amsterdam, the Netherlands

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THANK YOU FOR THE KIND ATTENTION!!