ORIGINAL ARTICLE

Oncologic effectiveness and safety of laparoscopic renal cryosurgery guided by high definition laparoscopic ultrasound


a Urology Service Administration, Hospital Central Militar, Mexico City, Mexico
b Urology Specialty Residency, Escuela Militar de Graduados de Sanidad, Mexico City, Mexico
c Clinical Administration of Medical Specialties, SEDENA, Mexico City, Mexico
d Urology Ward Administration, Hospital Central Militar, Mexico City, Mexico
e Urology Operating Room Administration, Hospital Central Militar, Mexico City, Mexico
f Urology Service, Hospital Central Militar, Mexico City, Mexico

KEYWORDS
Cryoablation; Renal cryosurgery; Renal tumor; Cryocatheter; Laparoscopic cryotherapy; Mexico.

Abstract

Background: The necessity and desire for definitive treatment in T1 tumors in patients that had previously been considered inoperable has resulted in the addition of cryoablation to the treatment armamentarium.

Aims: To determine the experience, results, and complications of this treatment in our hospital center.

Material and methods: Laparoscopic renal cryoablation guided by laparoscopic ultrasound was surgically indicated in 8 renal tumor patients with multiple comorbidities at the Hospital Central Militar.

Results: The mean age of the patients was 54.3 years and the mean size of the lesions was 28 mm. The lesion reduction percentage average was 47%. There were no complications of conversion, urinary fistulas, or renal loss. The incidence of clear cell carcinoma was 75%, and angiomylipoma was present in 25% of the lesions.

Discussion: The oncologic effectiveness of this management is still being defined; our results suggest that it offers a feasible, safe, and effective treatment opportunity to those patients in need of maximum nerve-sparing management.

Conclusions: After a decade of international experience, there have been few studies carried out on the Mexican population. Given the favorable results of our study, we feel it is necessary to continue and promote long-term studies, and we stress the importance that learning to perform this modality has for today’s urologist.

* Corresponding author at: Hospital Central Militar. Blvd. Manuel Ávila Camacho s/n, Lomas de Sotelo, Av. Industria Militar y General Cabrál, Delegación Miguel Hidalgo, C.P. 11200, México D.F., México. Telephone: (01) 5557 3100, ext. 1246. Email: drjgaducampos@hotmail.com (J. G. Campos-Salcedo).
Introduction

Twenty years ago, Dr. Andy Novick was one of the pioneers of the concept of open partial renal surgery, in an effort to promote the nephron-sparing approach as part of the oncologic principles.¹ Thanks to great technological advances, both the oncologic principle and the maximum renal function are now able to be preserved. Today, the situation is as Dr. Novick had imagined it, but with the advantage that these technologies are available in most parts of the world for all patients, offering an excellent treatment alternative to the patient with multiple comorbidities. New improvements are added daily to this renal preservation that are minimally invasive and focus largely on treatment. This is the case with laparoscopy, cryosurgery, and high definition laparoscopic ultrasound, and the common objective is our patients’ wellbeing.

Cryotherapy has a lethal local effect resulting from 2 sequential synergic mechanisms. The first is the so-called direct cytotoxic lesion due to the formation of ice crystal during the freezing phase, and is followed by the damage from indirect ischemia due to the occlusion of the local microvasculature during the consequent thawing phase.²

In laparoscopic renal cryoablation, the cryocatheter can be precisely positioned and the entire surgical event of ice ball formation can be monitored in real time and under direct vision through ultrasound guidance.³

The growing enthusiasm surrounding minimally invasive surgery and the need and desire for definitive treatment of T1a incidental renal tumors has turned laparoscopic renal cryoablation into another treatment alternative for small renal tumors in patients who in the past would not have been candidates for surgical treatment.⁴ ⁵ ⁶

Methods

A descriptive study was conducted on 8 selected patients presenting with T1aN0M0 renal masses indicated for nephron-sparing surgery for a variety of reasons that included having only one kidney due to previous renal tumor, having kidney failure, etc. The inclusion criteria are grouped together in table 1. The exclusion criterion was if the patient did not comply with the follow-up measures dictated by our hospital center.

All the patients underwent percutaneous renal biopsy, as recommended in the urologic clinical guidelines of the European Association of Urology for ablative therapies in the same surgical procedure as the renal cryoablative.⁵ Two cores per renal lesion were taken (fig. 1).

Laparoscopic renal cryoablation guided by high definition laparoscopic ultrasound was performed on 8 lesions characterized by tomography in patients with T1aN0M0 renal tumors. All the patients presented with multiple comorbidities that did not form part of the inclusion, non-inclusion, or exclusion criteria; they will be characterized further on in the text.

In this case series there was no control group.

At the Hospital Central Militar, with the Cryocare Surgical System (Endocare Inc., Irvine, Calif, USA) equipment, 17Ga cryocatheters were used (figs. 2 and 3) that underwent two 10-min freezing cycles. The real time formation of the ice ball was observed with 10 mHz BK Pro-Focus 2202 high definition laparoscopic ultrasonographic guide (fig. 4) until it completely covered the tumor mass and surrounded it by an approximate 8 mm margin (fig. 5).
**Results**

The mean age of the patients analyzed was 54.3 years; 87% (n=7) of the patients were operated on with the laparoscopic approach (fig. 6). Their lesions measured a mean 28 mm (40-22 mm). Only the first patient was operated on with the open technique; we decided to include this patient in our case series for the purpose of showing oncologic control results. The sequential sizes of the lesions were reduced in one case down to 0 mm, with an average lesion reduction percentage of 47%. There were no complications of conversion to open surgery, urinary fistulas, renal loss, or the need for dialysis. The mean preoperative creatinine value was 1 mg/dL and the post-cryosurgery value was 1.2 mg/dL. The histopathologic report of the biopsies stated clear cell carcinoma in 75% of the lesions and angiomyolipoma in 25%. These results are shown in table 2.

It should be mentioned that one of the patients died due to causes other than the renal tumor and so the oncologic control could not be carried out. This patient was included only for the immediate postoperative progression and was eliminated in the tomographic control.

**Discussion**

The oncologic effectiveness of laparoscopic renal cryosurgery has not yet been completely defined due to the follow-up time in different case series, which has also been documented in the cryosurgery tendencies in Mexico. However, our results suggest that it offers a feasible, safe, and effective treatment for renal masses in patients that require maximum nephron-sparing management, providing them with an opportunity for treatment.7-10

**Conclusions**

After more than 10 years of experience worldwide, there are only a few long and medium-term studies on the results...
of this technique in the Mexican population, despite the numerous benefits it has shown. We have presented the results of a medium-term follow-up at a Mexican tertiary care hospital where laparoscopic renal cryoablation guided by high definition laparoscopic ultrasound is carried out. It is necessary to continue and promote long-term studies, given that the results are becoming more and more favorable for patients. We corroborate the fact that the application of this ablation therapy provides the patient with an opportunity for treatment, and many improvement prospects. The patient is benefitted physically through a better quality of life that is a characteristic of minimally invasive surgery, as well as psychologically, given that the preoccupation caused by being “surgically inoperable” is reduced, maintaining the oncologic principles. For these reasons we stress the importance and great usefulness that learning this technique has for the practicing urologist, as well as for those in training. For the benefit of the patients, it should always be kept in mind when making therapeutic decisions.

Conflict of interest

The authors declare that there is no conflict of interest.

**Table 2** Result compilation. Specific results for each lesion. The first column to the left shows the lesion number and the second column shows the TNM staging according to the 2010 European Association of Urology guidelines.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>TNM</th>
<th>Tumor size (mm)</th>
<th>Comorbidities</th>
<th>Pre-op creat</th>
<th>DHS</th>
<th>Post-op creat</th>
<th>Post-op UO ml/kg/hr</th>
<th>Cryolesion reduc (%)</th>
<th>HPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31</td>
<td>T1aNOM0</td>
<td>39</td>
<td>Right single kidney due to left Wünderlich syndrome</td>
<td>0.85</td>
<td>8</td>
<td>1.0</td>
<td>1.6</td>
<td>89.7</td>
</tr>
<tr>
<td>2</td>
<td>31</td>
<td>T1aNOM0</td>
<td>42</td>
<td>Right single kidney due to left Wünderlich syndrome</td>
<td>0.85</td>
<td>8</td>
<td>1.0</td>
<td>1.6</td>
<td>89.7</td>
</tr>
<tr>
<td>3</td>
<td>38</td>
<td>T1aNOM0</td>
<td>20</td>
<td>DM</td>
<td>0.8</td>
<td>8</td>
<td>1.0</td>
<td>1.4</td>
<td>33</td>
</tr>
<tr>
<td>4</td>
<td>72</td>
<td>T1aNOM0</td>
<td>31</td>
<td>Sub. Mesenteric hepatic thrombosis/DM2/HBP/chronic liver disease</td>
<td>0.8</td>
<td>21</td>
<td>1.1</td>
<td>1.0</td>
<td>100%</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>T1aNOM0</td>
<td>30</td>
<td>ccRCC/PN 2004 and cryo 2007/CKF/HPO/HBP</td>
<td>1.8</td>
<td>11</td>
<td>2.6</td>
<td>0.1</td>
<td>89%</td>
</tr>
<tr>
<td>6</td>
<td>62</td>
<td>T1aNOM0</td>
<td>23</td>
<td>ccRCC 2007</td>
<td>1.1</td>
<td>4</td>
<td>1.7</td>
<td>0.5</td>
<td>15%</td>
</tr>
<tr>
<td>7</td>
<td>49</td>
<td>T1aNOM0</td>
<td>20</td>
<td>DM2</td>
<td>1.0</td>
<td>1</td>
<td>0.8</td>
<td>1.0</td>
<td>15%</td>
</tr>
<tr>
<td>8</td>
<td>79</td>
<td>T1aNOM0</td>
<td>22</td>
<td>DM2</td>
<td>0.8</td>
<td>3</td>
<td>1.2</td>
<td>1.0</td>
<td>0%</td>
</tr>
</tbody>
</table>

DM2: diabetes mellitus type 2; HBP: high blood pressure; Pre-op creat: preoperative serum creatinine; DHS: Days of hospital stay; Post-op creat: Postoperative serum creatinine at 24 hours; UO: Urinary output; Cryolesion reduc: Cryolesion reduction percentage; HPS: Histopathologic study report; AML: angiomyolipoma; ccRCC: Clear cell renal cell carcinoma.
Financial disclosure

No financial support was received in relation to this article.

References