Defining the position of cryoablation in the therapeutic armamentarium of small renal masses
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Chapter 8

Quality of life and perceived pain after laparoscopic assisted renal cryoablation: a prospective longitudinal study

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Chapter 8

ABSTRACT

Purpose
Assessing changes in quality of life (QoL) and perceived pain following laparoscopic assisted cryoablation (LAC) of renal tumours.

Materials and Methods
Data of 57 patients treated with LAC were prospectively collected. QoL, divided into various domains, and postoperative pain were assessed using the Medical Outcome Study 36-item Short Form Health Survey (SF-36), the European Organization for Research and Treatment of Cancer QLQ-C30 (EORTC-QLQ-C30) and Visual Analogue Scale (VAS). Assessment was done at baseline and different time intervals until one year after LAC. Using a repeated measures ANOVA the influence of the following parameters was evaluated: time of assessment, age, comorbidity, the occurrence of a complication, and tumour histology.

Results
SF-36: At baseline only general health perceptions scored lower compared to the general population. Time of assessment and a complication did not affect QoL. Comorbidity and age >70 lead to a significant lower QoL. Tumour histology affected general health perceptions. EORTC-QLQ-C30: Time of assessment affected 7/15 domains due to lower scores after two weeks. Age and comorbidity each negatively influenced five domains. A complication increased three symptoms scores and lowered general health status. Tumour histology significantly altered role functioning. VAS: VAS reached a peak one day after LAC, then quickly declined. Patients >70 years had significant higher VAS.

Conclusions
QoL of patients treated with LAC showed a decrease two weeks after surgery, but normalized to baseline within 3 months. Especially age and comorbidities negatively affected QoL. VAS showed a peak one day after LAC and then quickly declined.
INTRODUCTION

Ablation therapies are receiving increased interest as an alternative treatment for small renal masses (SRMs). Randomized controlled trials comparing surgical and ablation treatments for SRM are currently lacking, but a recent meta-analysis showed similar progression free survival rates for partial nephrectomy, radiofrequency ablation (RFA) and cryoablation [1]. This makes quality of life (QoL) an important decision making factor for patients and physicians.

Although several studies describe QoL after open partial and radical nephrectomy [2] and there is one report about QoL after percutaneous RFA [3], there is no data on QoL after cryoablation of renal tumours. In the current study we prospectively evaluated changes in QoL and perceived postoperative pain of patients treated with laparoscopic assisted cryosurgery (LAC) of a SRM and whether this is influenced by certain patient and tumour characteristics.

PATIENTS AND METHODS

Data of all patients treated with LAC of a SRM were prospectively collected between September 2003 and February 2008. After taking intraoperative biopsies LAC was performed using an argon-based cryosystem and 17G cryoprobes (SeedNet GoldSystem, Galil, Tel Aviv, Israel). Patients were included with a minimum follow-up of one year. Patients that did not possess sufficient knowledge of the Dutch language were excluded. Patients receiving two treatments because of bilateral tumours were censored after the second cryoablution.

QoL was assessed using a generic and cancer-specific questionnaire: the Medical Outcome Study 36-item Short Form Health Survey (SF-36) [4-6] and the European Organization for Research and Treatment of Cancer QLQ-C30 (EORTC-QLQ-C30) [7,8]. For evaluation of pain severity a Visual Analogue Scale (VAS) was used [9].

Baseline questionnaires and VAS were completed one to three days prior to surgery. The SF-36 was completed three and nine months after LAC; the EORTC-QLQ-C30 two weeks, three months and one year after LAC. Pain severity was assessed at day one, two weeks and three months postoperatively.

During the first postoperative outpatient visit two weeks after LAC, patients were informed about the histopathology and the proposed follow-up. Patients with a non-diagnostic biopsy outcome received a follow-up as if the SRM was malignant. Further follow-up included cross sectional imaging studies at three, six, nine months and one year after LAC.
The influence of the following parameters was analysed:
1. Time of assessment.
2. Patients age. Categories: <60; 60 – 70; >70.
3. American Society of Anaesthesiologists (ASA) score [10]. Categories: 1; 2; 3.
4. The occurrence of a complication; intraoperative, and/or within 30 days after LAC. Categories: yes; no.
5. Tumour histology. Categories: benign or malignant (including non-diagnostic biopsies). We estimated that tumour histology would not influence pain severity, so its influence on VAS was not analysed.

Statistical analysis
Analyses were conducted using SPSS®16.0.2. To compare the scores at the different time intervals and evaluate the effect of the different parameters, a repeated measures ANOVA (mixed model) was used (variance-covariance structure: First order Autoregression). The assumptions of normally distributed residuals and equal variances were tested using the Shapiro-Wilks (W>0.90) and Levene's test, respectively. When an assumption was violated, the scores were rank transformed. If multiple parameters showed a significant influence they were introduced into a multivariable analysis.

At baseline, z-scores were calculated for each domain of the SF-36 to compare patients with age and sex-matched Dutch normative data. Differences between patients’ data and these nation-norm data were tested with the Wilcoxon signed ranks test.

RESULTS
During the study period 57 patients met the inclusion criteria; six did not. Clinical data are shown in table 1. Two patients showed residual tumour on the first imaging study and were retreated; they were excluded after re-treatment. During the study period five patients died of unrelated causes.

Table 2 shows the number of questionnaires and VAS completed, and the reason if they were not completed. Table 3, 4 and 5 show the scores at the different times of assessment for the SF-36, EORTC-QLQ-C30 and VAS respectively, including the effect of the different parameters.
Table 1 Clinical data

<table>
<thead>
<tr>
<th>Patients, n (♂ : ♀)</th>
<th>57 (40 : 17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yrs (mean, range)</td>
<td>66 (40 – 86)</td>
</tr>
</tbody>
</table>

Categories:
- <60 (n) 16
- 60 – 70 (n) 19
- >70 (n) 22

ASA 1:
- 2 31 (54.4 %)
- 3 18 (31.6 %)

Tumours, n 59*

Tumour size, cm (mean, range) 2.5 (1 – 4.5)

Tumour type, n (%):
- RCC 38 (59.3 %)
- Oncocytoma 8 (13.6 %)
- Angiomyolipoma 2 (3.4 %)
- No biopsy taken 2 (3.4 %)
- Nondiagnostic 12 (20.3 %)

Complications: 12 in 10 patients, n
- Conversion to open procedure due to hypercapnia 1
- Urinary tract infection (UTI) 3
- Pain and fever 1
- Perirenal haematoma 2
- Corneal eye lesion (due to insufficient closure during surgery) 1
- Ileus 1
- Atrial fibrillation 1
- Myocardial infarction (MI) 1
- Death due to MI 3 weeks after LAC 1

*Two patients were treated with LAC for two ipsilateral renal tumours in one session.
### Table 2 Number of questionnaires and VAS completed during follow up

<table>
<thead>
<tr>
<th>Reason not completed</th>
<th>Baseline</th>
<th>1 day</th>
<th>2 weeks</th>
<th>3 months</th>
<th>9 months</th>
<th>1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>EORTC-QLQ-C30</td>
<td>57</td>
<td>54</td>
<td>46</td>
<td>38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SF-36</td>
<td>56</td>
<td>45</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAS</td>
<td>56</td>
<td>53</td>
<td>54</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>1/1</td>
<td>3</td>
<td>3/2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Deceased*</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comorbidity**</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treated for residual tumour</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow up elsewhere</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lost to follow up</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second cryoablation***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missed check up****</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

* All deaths were unrelated to RCC.
** Due to comorbidities some patients were unable to come to the outpatient clinic for their regular check up.
*** After cryoablation of a second renal tumour in the contralateral kidney, these patients were censored.
**** These patients were allowed to miss the 9-month check up since the imaging study at 6 months showed no suspicious enhancement.

### Figure 1 Box plots for the domains of the EORTC-QLQ-C30 at baseline and different moments after LAC.
Only the domains are shown that were significantly affected by time. The thick black line represents the median value, the box the first and third quartile; the error bars the fifth and 95th percentile of the data. Circles and stars represent outliers.
<table>
<thead>
<tr>
<th>SF-36</th>
<th>Baseline z-scores</th>
<th>Baseline absolute ^</th>
<th>3 months ^</th>
<th>9 months ^</th>
<th>Effect of time</th>
<th>Effect of other parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>median (range)</td>
<td>median (range)</td>
<td>median (range)</td>
<td>median (range)</td>
<td>Age</td>
<td>ASA</td>
</tr>
<tr>
<td>Physical functioning (PF)</td>
<td>-0.18 (-3.37 – 0.74)</td>
<td>80 (10 – 100)</td>
<td>88 (0 – 100)</td>
<td>p = 0.871</td>
<td>p &lt; 0.001*</td>
<td>p = 0.049*</td>
</tr>
<tr>
<td>Roles physical (RP)</td>
<td>-0.05 (-2.15 – 0.64)</td>
<td>75 (0 – 100)</td>
<td>100 (0 – 100)</td>
<td>p = 0.145</td>
<td>p = 0.005*</td>
<td>p = 0.242</td>
</tr>
<tr>
<td>Bodily pain (BP)</td>
<td>0.37 (1.92 – 1.07)</td>
<td>84 (31 – 100)</td>
<td>100 (0 – 100)</td>
<td>p = 0.705</td>
<td>p = 0.060</td>
<td>p = 0.120</td>
</tr>
<tr>
<td>General health perception (GH)</td>
<td>-0.21 (-2.28 – 1.20)</td>
<td>67 (25 – 100)</td>
<td>72 (25 – 100)</td>
<td>72 (25 – 87)</td>
<td>p = 0.300</td>
<td>p = 0.002*</td>
</tr>
<tr>
<td>Vitality (VT)</td>
<td>-0.21 (-2.57 – 1.69)</td>
<td>95 (20 – 100)</td>
<td>66 (0 – 95)</td>
<td>p = 0.396</td>
<td>p = 0.019*</td>
<td>p = 0.508</td>
</tr>
<tr>
<td>Social functioning (SF)</td>
<td>0.14 (-2.69 – 0.70)</td>
<td>88 (25 – 100)</td>
<td>100 (25 – 100)</td>
<td>94 (13 – 100)</td>
<td>p = 0.091</td>
<td>p = 0.100</td>
</tr>
<tr>
<td>Roles emotional (RE)</td>
<td>0.33 (-2.53 – 0.53)</td>
<td>100 (0 – 100)</td>
<td>100 (0 – 100)</td>
<td>p = 0.522</td>
<td>p = 0.073</td>
<td>p = 0.070</td>
</tr>
<tr>
<td>Mental health (MH)</td>
<td>-0.06 (-2.83 – 1.31)</td>
<td>76 (28 – 100)</td>
<td>80 (36 – 100)</td>
<td>74 (8 – 100)</td>
<td>p = 0.402</td>
<td>p = 0.004*</td>
</tr>
<tr>
<td>Questionnaires completed (n)</td>
<td>56</td>
<td>56</td>
<td>45</td>
<td>26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^ Higher scores represent a better QoL.

# p = 0.028 (based on negative ranks)

* p < 0.05 (significant effect)

^ Higher scores represent a better QoL.
Table 4: EORTC-QLQ-C30

<table>
<thead>
<tr>
<th>EORTC-QLQ-C30</th>
<th>Baseline *</th>
<th>2 weeks *</th>
<th>3 months *</th>
<th>1 year *</th>
<th>Effect of time</th>
<th>Effect of other parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>median (range)</td>
<td>median (range)</td>
<td>median (range)</td>
<td>median (range)</td>
<td></td>
<td>Age</td>
</tr>
<tr>
<td>Global health status (QLQ)</td>
<td>83 (17 – 100)</td>
<td>75 (0 – 100)</td>
<td>75 (25 – 100)</td>
<td>83 (42 – 100)</td>
<td>p = 0.061</td>
<td>p = 0.057</td>
</tr>
<tr>
<td>Physical functioning (PF)</td>
<td>78 (0 – 100)</td>
<td>67 (33 – 100)</td>
<td>80 (33 – 100)</td>
<td>80 (33 – 100)</td>
<td>p = 0.001*</td>
<td>p = 0.004*</td>
</tr>
<tr>
<td>Role functioning (RF)</td>
<td>100 (0 – 100)</td>
<td>0 (0 – 100)</td>
<td>100 (0 – 100)</td>
<td>100 (0 – 100)</td>
<td>p &lt; 0.001*</td>
<td>p = 0.274</td>
</tr>
<tr>
<td>Emotional functioning (EF)</td>
<td>83 (17 – 100)</td>
<td>83 (8 – 100)</td>
<td>92 (8 – 100)</td>
<td>92 (8 – 100)</td>
<td>p = 0.089</td>
<td>p = 0.075</td>
</tr>
<tr>
<td>Cognitive functioning (CF)</td>
<td>100 (0 – 100)</td>
<td>83 (0 – 100)</td>
<td>92 (0 – 100)</td>
<td>100 (0 – 100)</td>
<td>p = 0.003*</td>
<td>p = 0.268</td>
</tr>
<tr>
<td>Social functioning (SF)</td>
<td>100 (17 – 100)</td>
<td>83 (33 – 100)</td>
<td>100 (67 – 100)</td>
<td>100 (33 – 100)</td>
<td>p &lt; 0.001*</td>
<td>p = 0.290</td>
</tr>
<tr>
<td>Fatigue (FA)</td>
<td>22 (0 – 78)</td>
<td>33 (0 – 100)</td>
<td>22 (0 – 100)</td>
<td>22 (0 – 89)</td>
<td>p = 0.001*</td>
<td>p &lt; 0.001*</td>
</tr>
<tr>
<td>Nausea &amp; vomiting (NV)</td>
<td>0 (0 – 67)</td>
<td>0 (0 – 67)</td>
<td>0 (0 – 58)</td>
<td>0 (0 – 67)</td>
<td>p = 0.010*</td>
<td>p = 0.254</td>
</tr>
<tr>
<td>Pain (PA)</td>
<td>0 (0 – 100)</td>
<td>33 (0 – 100)</td>
<td>0 (0 – 100)</td>
<td>0 (0 – 100)</td>
<td>p &lt; 0.001*</td>
<td>p = 0.011*</td>
</tr>
<tr>
<td>Dyspnoea (DY)</td>
<td>0 (0 – 100)</td>
<td>0 (0 – 100)</td>
<td>0 (0 – 100)</td>
<td>0 (0 – 100)</td>
<td>p = 0.505</td>
<td>p = 0.174</td>
</tr>
<tr>
<td>Insomnia (SL)</td>
<td>0 (0 – 100)</td>
<td>17 (0 – 100)</td>
<td>0 (0 – 100)</td>
<td>0 (0 – 100)</td>
<td>p = 0.753</td>
<td>p = 0.007*</td>
</tr>
<tr>
<td>Loss of appetite (AP)</td>
<td>0 (0 – 67)</td>
<td>0 (0 – 100)</td>
<td>0 (0 – 100)</td>
<td>0 (0 – 100)</td>
<td>p = 0.064</td>
<td>p = 0.054</td>
</tr>
<tr>
<td>Constipation (CO)</td>
<td>0 (0 – 67)</td>
<td>0 (0 – 67)</td>
<td>0 (0 – 33)</td>
<td>0 (0 – 67)</td>
<td>p = 0.164</td>
<td>p = 0.004*</td>
</tr>
<tr>
<td>Diarrhoea (DI)</td>
<td>0 (0 – 67)</td>
<td>0 (0 – 100)</td>
<td>0 (0 – 67)</td>
<td>0 (0 – 67)</td>
<td>p = 0.767</td>
<td>p = 0.848</td>
</tr>
<tr>
<td>Financial impact (FI)</td>
<td>0 (0 – 100)</td>
<td>0 (0 – 67)</td>
<td>0 (0 – 67)</td>
<td>0 (0 – 33)</td>
<td>p = 0.205</td>
<td>p = 0.225</td>
</tr>
</tbody>
</table>

* p < 0.05 (significant effect)
^ For the global and functional domains higher scores represent higher QoL; for the symptom and financial scores the reverse is true.
Chapter 8

Table 5 VAS

<table>
<thead>
<tr>
<th>VAS</th>
<th>Baseline</th>
<th>1 day</th>
<th>2 weeks</th>
<th>3 months</th>
<th>Effect of time</th>
<th>The effect of other parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>median (range)</td>
<td>median (range)</td>
<td>median (range)</td>
<td>median (range)</td>
<td>Age</td>
<td>ASA</td>
</tr>
</tbody>
</table>
| VAS completed (n) | 56 | 53 | 54 | 45 | 0 (0 – 75) | 31 (0 – 89) | 6 (0 – 84) | 0 (0 – 78) | $p < 0.001^*$ | $p = 0.030^*$ | $p = 0.523$ | $p = 0.092$

* $p < 0.05$ (significant effect)

Figure 2 Box plot of the VAS-scores at baseline and different moments after LAC

The thick black line represents the median value; the box the first and third quartile; the error bars the fifth and 95th percentile of the data. Circles and stars represent outliers.

SF-36

Compared to the general Dutch population (the $z$-scores), at baseline only the general health perception of our patients was significantly lower.

Looking at the absolute scores of the SF-36, time of assessment and the occurrence of a complication had no significant effect on any domain. Age affected 5/8 domains; scores were significantly lower for the two older age categories. Patients with ASA3 scored significantly lower on physical functioning and general health perception than patients with ASA1 or 2. Patients with a malignant tumour showed a higher score on general health perception than patients with a benign tumour.
In a multivariable analysis age and tumour histology remained independent predictors for general health perceptions (p=0.001 and p=0.034 resp.), while there were no independent predictors for physical functioning.

**EORTC-QLQ-C30**

Time of assessment statistically significantly affected 7/15 domains of the EORTC-QLQ-C30 (fig. 1). For all domains this was due to the scores two weeks after cryoablation; these were significantly lower for the functional domains and significantly higher for the symptoms. Age affected five domains; physical functioning was significantly lower for the oldest age group, while the four symptom scores were significantly higher.

ASA had a statistically significant effect on 5/15 domains. The global health status was significantly higher for patients with ASA1 compared to ASA3. Patients with ASA3 scored significantly higher on fatigue, nausea and vomiting and constipation compared to patients with ASA1 and 2. ASA3-patients scored significantly higher on dyspnoea than ASA2-patients (patients with ASA1 had an intermediate score).

A complication statistically significantly affected global health status; scores being lower for patients with a complication. Additionally, there was a significant higher score on dyspnoea, loss of appetite and constipation in patients with a complication. Tumour histology significantly affected role functioning; scores were lower for patients with benign tumour histology.

In the multivariable model, there were no independent predictors of global health status, role functioning, fatigue or dyspnoea. For physical functioning both time and age were independent predictors (p=0.001 and p=0.004 resp.), and the same was true for pain (p=0.043 and p=0.029 resp.). Time and ASA were independent predictors for nausea and vomiting (p=0.014 and p=0.034 resp.), while age and ASA were independent predictors for constipation (a complication was not).

**VAS**

Time of assessment had a significant effect on VAS (fig. 2). The highest VAS was reached one day after LAC and then declined, but remained significantly higher compared to baseline; at 3 months it had not returned to baseline levels. Age also had a significant effect on VAS; patients older than 70 years having significantly higher scores. The occurrence of a complication did not affect VAS.

In a multivariable analysis, both time (p=0.001) and age (p=0.037) were independent predictors.
DISCUSSION

To assess the benefits of an intervention it is essential to provide evidence of the impact on QoL [11,12]. The SF-36 and EORTC-QLQ-C30 are two of the most widely used questionnaires and are proven to be valid, reliable and responsive to change [12]. The different times of assessment were chosen to capture the relevant changes in QoL: one at baseline, one just after surgery when incidence of complications is highest, and a final assessment for long-term effects.

QoL and pain are personal, subjective, and may be influenced by many different factors. The number of parameters that can be analysed statistically is limited by the number of patients. We selected our parameters based on their objective and reproducible character, and their clinical significance.

We compared the QoL of the patients in the current series with the QoL of the general Dutch population, and the SF-36 score on ‘general health perceptions’ was significantly lower. It seems plausible that this is caused by the awareness of the presence of a tumour in our patients.

Time did not affect any of the SF-36 domains, but did significantly affect seven domains of the EORTC-QLQ-C30. Most probably this was due to the different timing of the first postoperative evaluation of the two questionnaires: two weeks after cryoablation for the EORTC-QLQ-C30 and three months after cryoablation for the SF-36. These different times of first postoperative assessment were chosen since the timeframe for the questions of the EORTC-QLQ-C30 is the past week and the past four weeks for the SF-36. It seems logical that two weeks after LAC patients still experienced the effects of surgery. After three months most domains of the EORTC-QLQ-C30 had returned to baseline levels, parallel to the SF-36.

Age is known to influence QoL; normative samples report an age-dependent decrease in QoL in the general population [13]. This is confirmed in the current study: five domains of each questionnaire were negatively affected by high age. As commonly described in studies on LAC, our patients have a relative high comorbidity as represented by their ASA-score. High comorbidity significantly influences QoL [13,14], also in our series: a high ASA-score negatively influenced multiple domains of both questionnaires.

Seventeen and a half percent of patients experienced a complication, the severity of which varied widely. We decided to assess whether the occurrence of any kind of complication lead to changes in QoL. Although none of the SF-36 domains were affected, four domains of the EORTC-QLQ-C30 were, including three symptom scores that were significantly higher. However, a complication was only an independent predictor for the symptom ‘loss of appetite’, suggesting the effect is mostly due to other parameters like age and ASA.
Of tumours smaller than 4cm - eligible for LAC - 23% are benign [15]. This is due to the fact that preoperatively it is difficult to differentiate RCC from certain benign lesions using imaging or biopsies. Also in our series 17% of the tumours were benign. Since the diagnosis of cancer and the fear of recurrence can have a serious impact on QoL we assessed the influence of tumour histology. Although most domains were not affected, interestingly, a benign histopathology negatively influenced general health perceptions of the SF-36 and role functioning of the EORTC-QLQ-C30. What causes this is difficult to explain. However, neither of the two questionnaires is specifically aimed at assessing fear of recurrence. For this purpose, other questionnaires are better suited.

Figure 2 shows that at baseline VAS is not zero for all patients, which may seem strange since SRMs are usually asymptomatic. Comorbidity probably did not play a role here, since ASA did not significantly affect VAS. A possible explanation is a non-specific pain that ultimately led to the diagnosis of the kidney tumour: most SRMs are found incidentally during the work-up of non-specific symptoms like abdominal or back pain [16].

As expected VAS increased immediately after surgery, and then quickly decreased. Because of the minimal invasive character of the treatment we hypothesized that VAS scores would have normalized three months after treatment. However, there was still a significant higher VAS score at this point compared to baseline. This may be regarded as a limitation to this study. However, although VAS had not normalized after three months, this did not significantly affect QoL; the domains of both questionnaires had returned to baseline after three months.

Age was also an independent predictor of VAS, with patients older than 70 years of age showing significantly higher VAS scores than younger patients. Consequently, in future more attention should be paid to pain management after LAC, especially in these older patients.

A limitation to this study is the decreasing number of completed questionnaires and VAS during follow-up (table 2). To evaluate whether this significantly influenced results, we compared the baseline characteristics (age, ASA, tumour histology, complication) of the patients that had filled out the questionnaires to those that had not filled them out (at nine months for the SF-36 and one year after treatment for the EORTC-QLQ-C30) using a Pearson Chi-square test or Fisher’s Exact test (when cells had an expected count less than five). This showed no statistically significant differences except for the occurrence of complications; for both the SF-36 and EORTC-QLQ-C30 there were significantly more patients with a complication that completed follow-up (p = 0.047 and p = 0.004 respectively). Therefore, valid conclusions can be drawn, although the effect of a complication may be overestimated.
The large amount of statistical tests conducted in this study makes it prone to Type I errors. Of the 119 univariate tests, 32 show a statistically significant effect with \( \alpha \) set at 5\% (the current situation). If we lower \( \alpha \) to 1\%, still 21 of the tests show a statistically significant outcome, also confirming our results.

It would have been interesting to compare QoL and VAS to the reference treatment, (laparoscopic) partial nephrectomy. A recent meta-analysis shows there is a selection bias in the clinical application of these techniques: ablative therapies are selectively applied in older patients with smaller tumours, whereas data on partial nephrectomy generally describes younger patients with larger lesions [1]. A matched cohort study would therefore be the most suitable to compare treatments.

Partial nephrectomy, RFA and cryoablation all have their own pros and cons, but from a QoL point of view we consider LAC certainly is a good option: even though the patients in the current study are of relative old age and have a high comorbidity, QoL returned to baseline levels within three months after treatment.
REFERENCES


10. Saklad M. Grading of patients for surgical procedures. Anesthesiology 1941; 2: 281-4


