Quality of Life in patients with low risk prostate cancer
A comparative retrospective study (Brachytherapy vs. Robot Assisted Laparoscopic Prostatectomy vs. Active Surveillance)

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Abstract

Objectives

To investigate the quality of life (QoL) after different treatment modalities of low risk prostate cancer, including brachytherapy, robot assisted laparoscopic prostatectomy (RALP), and active surveillance (AS) with validated questionnaires.

Material and Methods

From a prospective database we selected a total of 144 men with low-grade localized prostate cancer including 65 (45.1%) patients with RALP, 29 (20.2%) with brachytherapy, and 50 (34.7%) managed with AS. QoL was routinely evaluated with validated questionnaires (EORTC-QLQ-C30, EORTC-QLQ-PR25, IIEF-15, ICIQ-SF) with a minimum follow-up of one year.

Results

In comparison to baseline scores, the brachytherapy group showed a significant decrease of QoL domain scores of voiding complaints (p=0.010), use of incontinence aids (p=0.011), sexual functioning domain (p=0.011), and erectile function (p≤=0.001).

In the RALP group, sexual function (p≤=0.001), incontinence (p≤=0.001), and erectile function were significantly affected. A decrease in sexual function was observed in 71% of men after RALP and 59% after brachytherapy. In 30% of men under AS, a decrease of erectile function score during follow-up was reported. Overall, no significant decrease in general QoL was observed neither for men under AS, nor for men treated by brachytherapy or RALP. Clinical factors such as age, prostate size, PSA and nerve-preservation during RALP were non-predictive of overall-QoL after treatment for the individual patient (p=0.676).

Conclusion
Patients with low risk prostate cancer who are treated with brachytherapy or RALP report deterioration of quality of life of specific domains such as voiding, continence, and sexual functioning in comparison of AS patients. A decrease of erectile function was also observed during AS. Overall QoL was similar for all three treatments options.
Introduction
Cancer specific survival in men with low risk prostate cancer is good. In men over 70 the risk of dying from a newly diagnosed low risk (PSA<10, GS<7) prostate cancer is less than 10% \(^1\).

For low grade localized prostate cancer there are different kind of treatment modalities including brachytherapy, radical prostatectomy, and active Surveillance (AS). Radical prostatectomy and brachytherapy are known to have effects on quality of life on psychological and physical domains \(^2\). Many studies described side effects of radical prostatectomy, brachytherapy, including the sexual functions, or urinary and bowel problems \(^3,4\).

Men with low risk prostate cancer were five times more likely to die of other diseases and recent data from the randomized PIVOT trial show that 12-year survival in this group of men is not improved by local treatment such as prostatectomy compared to active surveillance (AS) \(^5\). Quality of Life (QoL) in men after local treatment may deteriorate in particular since most are asymptomatic from their prostate cancer at baseline. Many men therefore opt for AS.

AS may cause side-effects, mostly psychological, such as anxiety and distress and at least 30% of men will be treated with progressive disease during the initial years of AS \(^6,7\). For the decision making process, consulting the patients about the possible outcomes of treatment alternatives in localized prostate cancer and comparison of all aspects of current treatments is required. Hayes et al., estimated that AS may provide the most quality adjusted life years when compared to surgery or brachytherapy \(^8\).

In the current study, the general and disease specific prospectively sampled quality of life between three different approaches to low risk localized prostate cancer
including brachytherapy, RALP, and AS in patients from a single institute were compared.

Materials and methods

Setting

This study was performed at the Urology Department of the Antoni van Leeuwenhoek (AvL) Hospital in Amsterdam, the Netherlands. The eligible patients were extracted from the prospective prostate cancer database at the AvL Hospital.

Study design and participants

Among the original database of the AvL hospital for the patients with prostate cancer which consisted of 2615 patients with prostate cancer since 2004, men with low-risk localized prostate cancer according to D'Amico risk classification of prostate cancer (PSA<10 ng/dl, cT1-2a and GS<=6, number of positive biopsy core<= 2) were selected. Men that filled out the questionnaires pre- and post- treatment with a follow up period of at least 1 year were included. After diagnosis these patients had three different treatment options: brachytherapy, RALP, or AS. For the QOL analysis, patients treated with external beam radiation therapy (ERBT) were excluded since only a small number of low risk patients were available. Selection of treatment options was based on the following aspects: tumor characteristics, level of serum PSA, size of the prostate, number of positive biopsies, Gleason-score, age of the patient, voiding complaints, levels of anxiety of the patient on the prostate cancer diagnosis, and comorbidity.

Among a total of 144 patients: 65 patients were treated with RALP (45,1%), 50 with AS (34,7%) and 29 with brachytherapy (20,2%) were eligible for the analysis.
Flow chart of patient selection according to eligibility criteria is shown in Figure 1. The QoL outcome measures of patients with localized prostate cancer with their baseline QoL measures before treatment were compared.

**Data collection.**

Patients with localized prostate cancer completed validated questionnaires between 2004 and 2011. These questionnaires were routinely sent by regular mail or e-mail before patients visited the hospital for the first time. After treatment, the patients completed the same questionnaires again at regular intervals of 6 months. In order to evaluate of quality of life, the overall quality of life questionnaire (EORTC-QLQ-C30), prostate specific quality of life questionnaire (EORTC-QLQ-PR25), sexual functioning questionnaire (IIEF-15), and the incontinence questionnaire (ICIQ-SF) were used.

**Questionnaires**

**EORTC-QLQ-C30 / PR25 questionnaires**

EORTC-QLQ-C30 is a questionnaire used to evaluate the overall QoL of cancer patients. Questions are grouped as domains of QoL including the physical, social, emotional and cognitive functions, vitality / fatigue, pain, general health status, overall QoL and life satisfaction. Last two questions (29th and 30th questions) are used for the evaluation of overall QoL.

EORTC-QLQ-PR25 is a questionnaire based on prostate cancer specific QoL. It constitutes of 25 questions. This form is composed of 6 domains to evaluate the voiding complaints, problems due to incontinence, bowel problems, metabolic and endocrinological effects, sexual activity and sexual functions of the patients.
**IIEF-15 questionnaire**

Sexual functions of the patients were evaluated under the components of erectile function (EF), intercourse satisfaction (IS), orgasmic function (OF), overall satisfaction (OS) and sexual desire (SD) with IIEF-15. Patients with an IIEF-EF score of 19 and above are defined to have a normal or mildly affected erectile function.

**ICIQ-SF questionnaire**

ICIQ-SF is a questionnaire composed of four questions evaluating the severity of incontinence and QoL.

**Statistical analysis**

The questionnaires were checked for completeness and baseline QoL questionnaires were compared with follow up QoL questionnaires. Patient characteristics and questionnaire scores among the three groups were compared with the non-parametric Kruskal-Wallis test, followed by a Mann-Whitney analysis to specify differences among groups. To examine the relationship between baseline QoL domains and the independent variables, age and size of the prostate, we used the non-parametric Spearman’s correlation coefficient test. The non-parametric Wilcoxon signed rank test was used to test whether there were significant differences between baseline QoL and follow up QoL within the three groups. To observe significant differences in QoL domains of individual patients, we used the Chi-Square test to compare patients who had a decline of specific QoL domains, to patients who had an improvement, or equal score of specific QoL domains. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 20.0. The level of significance is accepted as p<0.05.

**Results**
Median follow up of the brachytherapy group was 40 months (12.3-169.1 months), the RALP group was 21 months (12-54.4 months) and the AS group was 29.7 months (12-75.5 months) (p=0.001). A statistical significance was observed between the follow up periods of RALP and brachytherapy (p=0.001) groups and also between the RALP and AS groups (p = 0.007).

The patient characteristics at diagnosis according to treatment groups are shown in Table 1. The mean age of the entire population was 61.9±6.6 (ranged, 44-85) years. The mean age of the brachytherapy and AS group was higher than for the RALP group (p=0.002).

The mean iPSA of the entire population was 6.3±2.2 ng/ml. There was no significant difference between the three groups for iPSA (p=0.087) and number of positive biopsies (p=0.501).

The mean prostate volume of the entire population was 50.5±22.7 (ranged, 16-165)cc. The mean prostate volume in the brachytherapy group was not significantly different from the RALP group (p=0.629), but was higher for the AS group (p=0.008).

Baseline QoL

At baseline only significant differences in sexual function QoL scores were observed between the RALP and AS group: men in the RALP group had a significantly higher IIEF-15 (p=0.015), IIEF-EF (p=0.006), IIEF-OF (p=0.023), and IIEF-IS score (p=0.025) (Table 2). There were no significant differences seen among groups for PR25 domains and overall QoL between the groups.

Correlation between age and prostate size vs. QoL measures
There was a significantly inverse relation between age and QoL measures including sexual functions (PR domain 5), sexual activity (PR domain 6), IIEF-15 and its subdomains of IIEF-EF, IIEF-OF and IIEF-IS in all groups. A positive relation was observed between the age and overall QoL (EORTC-QLQ-C-30 domain 15). No relation was found between prostate size and any domain score.

**Comparison of baseline QoL measures with follow-up**

The graphical representation of the differences (%) of the QoL domains according to the patient groups is shown in Figure 2. The values and comparisons of QoL measures during follow up is shown in Table 2.

**RALP**

In the RALP group, there was significant deterioration in the domains of sexual function and use of incontinence aids (PR domain 2 and 6). A significant decrease was found in the domain scores of IIEF-15 total, IIEF-EF, IIEF-OF, IIEF-IS, IIEF-OS and ICIQ-SF total score.

**Brachytherapy**

In the brachytherapy group, a significant deterioration in the domain scores of voiding complaints, the use of incontinence aids, metabolic and endocrinological effects, and sexual functioning (PR domain 1, 2, 4, and 6) was found as well as measures of sexual functioning including IIEF-15 total, IIEF-EF and IIEF-SD impaired during follow up.

**AS**

In the AS group, there was only a significant decrease in QoL for the domain score of use of incontinence aids during follow up compared to baseline (PR domain 2).
There was no significant difference in the percent of patients with a decrease in overall QOL among treatment groups (38% for AS, 32% for RALP and 30% for brachytherapy, p>0.05). Significant decreases were found in terms of sexual functioning in 30% of AS group, 71% of RALP group and 59% of brachytherapy group (p=0.004). The deterioration of lower urinary tract symptoms in AS, RALP and brachytherapy was 43%, 40% and 58% of the patients, respectively (p<0.005).

Clinical factors such as age, prostate size, PSA and nerve-preservation during RALP were non-predictive of overall-QoL after treatment for the individual patient (p=0.676).

**Discussion**

The prognosis of low-risk prostate cancer is good even when an initial active surveillance management is considered. In particular in low risk disease, AS was shown to maintain QOL without compromising disease specific survival. In addition, QOL may be negatively affected by treatment options such as brachytherapy, and RALP. We hypothesized that patients in the AS group would have a better QoL outcome after an initial period of expectant management, compared with the QoL of patients treated with brachytherapy or RALP.

In the current study, a nonsignificant (-1%) decrease was observed in the general health-related QOL of AS group after treatment at least 1-year follow up. A mild increase in overall QOL was found in the brachytherapy and RALP groups compared to baseline values (1.5% and 3.4%, respectively).

Several studies addressed general QOL after management for localized prostate cancer. All reported little impact on overall QOL by local treatment 2,9,10,11 although some reported temporary effects than normalized within one year of treatment 11.
Active surveillance may lead to psychological problems that may affect the patients’ health related QOL. Van den Bergh et al. found limited involvement of the patient in the decision of AS, a low score of pretreatment physical health, high anxiety score and high PSA values as predictive factors of poor outcome of general QOL in an AS population\textsuperscript{12}. According to the results of a multi-centered international prostate cancer AS study (PRIAS), health related QoL and patients’ anxieties were stable at the first 9 months of AS\textsuperscript{13}. Studies with long follow-up are required to evaluate the proper effects of AS on health-related QOL. In our study, some of the baseline QoL domains were significantly different between the groups rendering comparison difficult. However, these differences existed only between men in the RALP and AS group. Men in the RALP group were younger and had better IIEF-15, IIEF-EF, IIEF-OF and IIEF-OS scores compared to the AS group. We also found a significant inverse correlation between age and sexual functions. This may explain the low sexual function scores in AS group. Selection bias to treatment instead of AS in younger men expecting to maintain erectile function with nerve sparing RALP may affect outcome.

Randomized controlled trails need to overcome this selection bias. Recently, Crook et al. reported health-related QoL of 168 patients who randomized to radical prostatectomy and brachytherapy in The American College of Surgeons Oncology Group phase III Surgical Prostatectomy Versus Interstitial Radiation Intervention Trial (SPIRIT) with a mean follow-up of 5.3 years\textsuperscript{14}. The authors stated that brachytherapy has better functional outcomes (urinary and sexual) and good patient satisfaction. Another study emphasized that the patients who had high expectations about functional outcome had reduced satisfaction\textsuperscript{15}. These aspects may affect QOL
outcome in particular considering the fact that even a randomized study can never be conducted in a double blind fashion.

All studies seem to agree to this point that overall QOL is only marginally affected by treatment choice in low risk prostate cancer patients. However, functional outcome may differ considerably between treatments. Radical prostatectomy has negative effects on several aspects of specific QoL including sexual and urinary functions. Technical improvements such as nerve-sparing techniques and robot assistance may help reduce the side effects related to erectile and voiding functions. In a prospective longitudinal study, some domains of QoL including score for cognitive, emotional and interpersonal relations returned to baseline in the first year after surgery in 71 men treated with RALP. However, the decrease in sexual desire, sexual confidence and self-esteem was permanent.

In the current study, RALP affected many domains of QoL with a mean follow-up period of 1.9 years. The use of incontinence aids and sexual functions prominently reduced in EORTC-PR25 questionnaire. RALP had negative effect on the overall sexual functions in IIEF-15 as well IIEF-EF, IIEF-OF, IIEF-IS and IIEF-OS despite the use of PDE5 inhibitors for penile rehabilitation in the majority of men. In addition, 71% of patients treated with RALP had a decrease in sexual function scores. Compared to AS and brachytherapy, men in the RALP group showed a higher postoperative ICIQ-SF incontinence score but fewer men in the RALP group had deterioration of lower urinary tract symptoms.

Radiation therapy (ERBT and brachytherapy) for prostate cancer has detrimental effects on urinary, sexual and intestinal functions. It may cause irritative voiding symptoms (urgency, pollakiuria and urge incontinence), bowel and rectal symptoms.
(tenesmus, hematochesia)\textsuperscript{4,21}. These symptoms may be observed either during or immediately after treatment. In a retrospective observational study, 143 localized prostate cancer patients after brachytherapy reported fecal incontinence symptoms affecting daily activities in 13.2% of patients during 2 years follow-up\textsuperscript{22}.

Roeloffzen et al. demonstrated that the patients treated with brachytherapy have significantly severe urinary symptoms, intestinal symptoms and pain as well as impaired physical functionality and sexual activity in 6-year follow up\textsuperscript{23}. They noted that only the changes in emotional and sexual functions were clinically important. Most of the men returned to their baseline health-related QoL within 1 year\textsuperscript{24}. Sanda et al. prospectively compared the QoL changes of radical prostatectomy, brachytherapy and ERBT in 1201 prostate cancer patients\textsuperscript{4}. In the brachytherapy group, a significant deterioration in urinary symptoms (irritation or obstruction and incontinence) was reported when compared with baseline values. Incontinence after brachytherapy was reported by 4-6% of patients at 1-2 years after treatment. Eighteen percent of patients in the brachytherapy group reported moderate or worse distress from overall urinary symptoms at 1 year.

In the current study, prostate cancer specific QoL (PR25 domains) in the brachytherapy group were significantly affected. Significant differences were observed in voiding symptoms, use of incontinence aids, metabolic and endocrinological effects and sexual functions in EORTC-PR25 questionnaire. Brachytherapy also had a negative impact upon sexual functions according to scores of IIEF-15, IIEF-EF and IIEF-SD and 59% of patients had a decrease in sexual function after brachytherapy whereas this percentage was 71% after RALP. However,
no significant difference was noted in terms of gastrointestinal side effects in the brachytherapy group (PR domain 3). These observations support data from the SPIRIT trial that brachytherapy may affect sexual functions to a lesser degree than RALP does.

There are several limitations in our study. The non-randomized setup causes a treatment selection bias. Second, it is important to note that 80% of all patients were referred to our tertiary oncological centre. This implies that in the study group, all patients were aware of the diagnosis prostate cancer at the time they filled in the questionnaires. This may have affected their QoL score. Since all groups were equally informed on the diagnosis of low risk prostate cancer we considered the AS group as the control group. The sample size of patients in our analysis was small. Not all patients were ineligible and the response rate to mailed questionnaires was 63%. Another limitation was the fact that comorbidities and age may have affected treatment choice. Men in the AS group were older. Permanent pathological findings after RALP and different profiles of progression of the disease may affect the QoL and satisfaction. Secondary treatments including adjuvant hormonal therapy or radiotherapy have a negative impact on QoL. Therefore, patients who received adjuvant therapy were excluded from the study for both the brachytherapy as well as the RALP group. Furthermore, no data on QoL effects of delayed local treatment in the AS group were collected. Since an expected 30% of men will need local treatment during the initial years of AS, longer follow up in the AS group may show alterations in QoL due to this treatment.

Conclusion
At baseline patients treated with AS showed lower physical QoL domains, especially erectile function compared to men selecting brachytherapy or RALP. Patients selecting AS were also older than patients who received RALP. No difference in overall QOL scores changes for men managed with AS, brachytherapy, or RALP were observed. The patients on AS showed relatively stable scores on physical QoL domains during follow-up, while the patients receiving brachytherapy or RALP showed decreasing scores on different measures, especially erectile function and incontinence. In addition, 30% of AS patients had a decrease in sexual functions during the follow up compared to 59% and 71% for brachytherapy and RALP treated patients respectively. Deterioration in voiding complaints was not more frequently after brachytherapy (58%) as compared to AS (43%) or RALP (40%). The effects of secondary of delayed treatments on QOL need further study.

ACKNOWLEDGEMENTS

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REFERENCES


Table 1. Patient characteristics at diagnosis by treatment group (n=144)

Table 2. Comparison of Baseline QoL measures with follow-up QoL. The QoL scores are recoded so that 100% reflects the highest and best QoL score and 0% the lowest score. The column % difference shows the % change of QoL score at follow up (improved QoL score in bold).

Figure 1: Flow chart of patient selection of the NKI-AvL prostate database

Figure 2a,b,c,d: Differences (%) in QoL outcome among three treatment groups for each QoL domain. The difference (%) is indicated by decline or by improvement of QoL (X axis). (*) indicates significant differences of each treatment group per QoL domain.

PSA: Prostate Specific Antigen
IPSA: initial PSA
GS: Gleason Score
AS: Active Surveillance
QoL: Quality of Life
RALP: Robot Assisted Laparoscopic Prostatectomy
ERBT: External Beam Radiation Therapy
AvL: Antoni von Leeuwenhoek
EORTC-QLQ-C30: The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Core 30
EORTC-QLQ-PR25: The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Prostate Module 25
ICIQ-SF: International Consultation on Incontinence Questionnaire Short Form
IIEF: International Index of Erectile Function
IIEF –EF: International Index of Erectile Function erectile function,
IIEF –IS: International Index of Erectile Function intercourse satisfaction
IIEF –OF: International Index of Erectile Function orgasmic function
IIEF –OS: International Index of Erectile Function overall satisfaction
IIEF –SD: International Index of Erectile Function sexual desire
Table 1.
Patient characteristics at diagnosis by treatment group (n=144)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>BT (n=29) (% )</th>
<th>RALP (n=65) (% )</th>
<th>AS (n=50) (% )</th>
<th>Total</th>
<th>p Value*</th>
</tr>
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<tbody>
<tr>
<td>Age ± SD (years)</td>
<td>5.5 ± 5.7 (49-76)</td>
<td>6.1 ± 6.1 (44-73)</td>
<td>6.9 ± 5.8 (49-73)</td>
<td>61.9 ± 6.6</td>
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<td>Initial PSA ± SD (ng/ml)</td>
<td>6.8 ± 1.9 (1.7-9.6)</td>
<td>6.4 ± 2.1 (1.8-10)</td>
<td>5.9 ± 2.1 (1.1-10)</td>
<td>6.3 ± 2.2</td>
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<td>Size prostate ± SD (cc)</td>
<td>13.6 ± 4.1 (25-68)</td>
<td>19.6 ± 4.6 (16-107)</td>
<td>27.8 ± 5.3 (20-165)</td>
<td>50.5 ± 22.7</td>
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<td>2 biopsies</td>
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<td>28 (43.1)</td>
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<td>Missing</td>
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<td>n=8 (14.6)</td>
<td>n=2 (4)</td>
<td>n=12</td>
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<td>Gleason-score</td>
<td>n=29 (%)</td>
<td>n=65 (%)</td>
<td>n=50 (%)</td>
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<tr>
<td>Grade 6</td>
<td>29 (100)</td>
<td>65 (100)</td>
<td>50 (100)</td>
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<tr>
<td>Clinical stage (cT-stage)</td>
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<td>Total (%)</td>
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<tr>
<td>cT1c</td>
<td>14 (3)</td>
<td>35 (53.8)</td>
<td>33 (66)</td>
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<tr>
<td>cT2a</td>
<td>15 (7)</td>
<td>30 (46.2)</td>
<td>17 (34)</td>
<td>62 (43.1)</td>
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*Kruskal-Wallis test (p<0.05); BT=brachytherapy; RALP= Robot Assisted Laparoscopic Prostatectomy; AS=Active Surveillance; SD=Standard Deviation; PSA=Prostate-Specific-Antigen; cT-stage=clinical Tumor-stage according to the TNM-classification (tumor, node, metastasis staging, EAU Guidelines 2009).
Table 2. Comparison of Baseline QoL measures with follow-up QoL.
The QoL scores are recoded so that 100% reflects the highest and best QoL score and 0% the lowest score. The column % difference shows the % change of QoL score at follow up (improved QoL score in bold).

<table>
<thead>
<tr>
<th>Brachytherapy</th>
<th>Domain</th>
<th>n</th>
<th>Mean baseline QoL (%)</th>
<th>SD</th>
<th>Mean follow-up QoL (%)</th>
<th>SD</th>
<th>% difference</th>
<th>p Value*</th>
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<tr>
<td>PR domain 1</td>
<td>7</td>
<td>10.47</td>
<td>2.92</td>
<td>12.37</td>
<td>5.1</td>
<td>-7.9%</td>
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<td>7</td>
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<td>0.00</td>
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<td>4.25</td>
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<td>0.63</td>
<td>6.88</td>
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<td>12.74</td>
<td>2.21</td>
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<td>3.0</td>
<td>-13.2%</td>
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<td></td>
<td></td>
<td>52.88</td>
<td>18.2</td>
<td>42.75</td>
<td>18.2</td>
<td>-14.5%</td>
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<tr>
<td>IIEF-15</td>
<td>8</td>
<td>68.4%</td>
<td>10.4</td>
<td>53.9%</td>
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<td>IIEF-EF</td>
<td>0</td>
<td>60.7%</td>
<td>3.35</td>
<td>46.9%</td>
<td>3.5</td>
<td>-15%</td>
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<td>IIEF-OF</td>
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<td>54.0%</td>
<td>7.0</td>
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<td>IIEF-SD</td>
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<td>1.42</td>
<td>40.6%</td>
<td>1.6</td>
<td>-35.6%</td>
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<tr>
<td>IIEF-IS</td>
<td>1</td>
<td>45.5%</td>
<td>4.85</td>
<td>38.8%</td>
<td>4.9</td>
<td>-6.7%</td>
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<td>1</td>
<td>60.2%</td>
<td>6.82</td>
<td>45.5%</td>
<td>5.8</td>
<td>-20.9%</td>
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<td>ICIQ-SF total</td>
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<td>100%</td>
<td>0.00</td>
<td>90.5%</td>
<td>2</td>
<td>-9.5%</td>
<td>0.180</td>
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<td>2</td>
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<td>16.2</td>
<td>81.77%</td>
<td>16.2</td>
<td>+1.5%</td>
<td>0.568</td>
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<td>2.45</td>
<td>11.81</td>
<td>2.4</td>
<td>-35.6%</td>
<td>0.000</td>
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This article has been peer-reviewed and accepted for publication, but has yet to undergo copyediting and proof correction. The final published version may differ from this proof.
### AS

<table>
<thead>
<tr>
<th>Domain</th>
<th>n</th>
<th>Mean baseline QoL (%)</th>
<th>SD</th>
<th>Mean follow-up QoL (%)</th>
<th>SD</th>
<th>% difference</th>
<th>p Value*</th>
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<tbody>
<tr>
<td>PR</td>
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<td>(100%)</td>
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<td>-26.8%</td>
<td>0.000</td>
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<tr>
<td>PR</td>
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<td>1.32</td>
<td>6.92</td>
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<tr>
<td>domain 3</td>
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<td>1.32</td>
<td>(96.0%)</td>
<td>0.6</td>
<td>-0.8%</td>
<td>0.182</td>
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<tr>
<td>domain 4</td>
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<td>(96.5%)</td>
<td>3.49</td>
<td>12.64</td>
<td>2.7</td>
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<td></td>
</tr>
<tr>
<td>PR</td>
<td>3</td>
<td>12.58</td>
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<td>(72.0%)</td>
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<td>+0.5%</td>
<td>0.939</td>
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<tr>
<td>domain 5</td>
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<td>(60.7%)</td>
<td>2.21</td>
<td>5.92</td>
<td>2.3</td>
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<tr>
<td>domain 6</td>
<td>3</td>
<td>(71.5%)</td>
<td>2.21</td>
<td>(49.0%)</td>
<td>5</td>
<td>-0.2%</td>
<td>0.876</td>
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</table>

**ICIQ-SF**

<table>
<thead>
<tr>
<th>Domain</th>
<th>n</th>
<th>Mean baseline QoL (%)</th>
<th>SD</th>
<th>Mean follow-up QoL (%)</th>
<th>SD</th>
<th>% difference</th>
<th>p Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>total</td>
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<td>(96.8%)</td>
<td>1.41</td>
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<td>-8.2%</td>
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**IIEF**

<table>
<thead>
<tr>
<th>Domain</th>
<th>n</th>
<th>Mean baseline QoL (%)</th>
<th>SD</th>
<th>Mean follow-up QoL (%)</th>
<th>SD</th>
<th>% difference</th>
<th>p Value*</th>
</tr>
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<tr>
<td>domain 1</td>
<td>1</td>
<td>(85.4%)</td>
<td>0.00</td>
<td>1.07</td>
<td>0.2</td>
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<tr>
<td>domain 2</td>
<td>4</td>
<td>(73.2%)</td>
<td>1.17</td>
<td>4.48</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>domain 3</td>
<td>0</td>
<td>(96.0%)</td>
<td>1.32</td>
<td>6.92</td>
<td>1.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>domain 4</td>
<td>7</td>
<td>(94.9%)</td>
<td>3.49</td>
<td>12.64</td>
<td>2.7</td>
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<td></td>
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<tr>
<td>domain 5</td>
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<td>3.8</td>
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<tr>
<td>domain 6</td>
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<td>(49.0%)</td>
<td>2.21</td>
<td>5.92</td>
<td>2.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PR domain 6**

- **IIEF-15**: Mean baseline QoL (%) = 41.11, Mean follow-up QoL (%) = 41.11, % difference = 0.0%, p Value* = 0.000
- **IIEF-EF**: Mean baseline QoL (%) = 11.83, Mean follow-up QoL (%) = 11.83, % difference = 0.0%, p Value* = 0.000
- **IIEF-OF**: Mean baseline QoL (%) = 78.17, Mean follow-up QoL (%) = 78.17, % difference = 0.0%, p Value* = 0.000
- **IIEF-SD**: Mean baseline QoL (%) = 61.58, Mean follow-up QoL (%) = 61.58, % difference = 0.0%, p Value* = 0.000
- **IIEF-IS**: Mean baseline QoL (%) = 80.4%, Mean follow-up QoL (%) = 80.4%, % difference = 0.0%, p Value* = 0.000
- **IIEF-OS**: Mean baseline QoL (%) = 80.4%, Mean follow-up QoL (%) = 80.4%, % difference = 0.0%, p Value* = 0.000

**ICIQ-SF**

- **ICIQ-SF**: Total Mean baseline QoL (%) = 0.68, Mean follow-up QoL (%) = 0.68, % difference = 0.0%, p Value* = 0.000
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<tr>
<th></th>
<th>2</th>
<th>7.04</th>
<th>4.85</th>
<th>7.04</th>
<th>4.7</th>
<th>-0.0%</th>
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<tbody>
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<td>IIEF-IS</td>
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<td>(46.9%)</td>
<td>4</td>
<td>0.826</td>
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<td>IIEF-OF</td>
<td>2</td>
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<td>2.68</td>
<td>6.00</td>
<td>2.6</td>
<td>0.431</td>
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<tr>
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<td>(55.1%)</td>
<td>5</td>
<td>-5.1%</td>
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<tr>
<td>ICIQ-SF</td>
<td>2</td>
<td>1.79</td>
<td>3.72</td>
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<tr>
<td>total</td>
<td>8</td>
<td>(91.5%)</td>
<td>9</td>
<td>+0.7%</td>
<td>0.721</td>
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<tr>
<td>QLQ-C30-domain</td>
<td>4</td>
<td>83.00%</td>
<td>15.2</td>
<td>82.02%</td>
<td>16.</td>
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<tr>
<td>15</td>
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<td>(11.6)</td>
<td>7</td>
<td>(11.84)</td>
<td>1</td>
<td>-1.0%</td>
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</table>

*p Value: Wilcoxon test (p<0.05). All the significant differences show a decrease in Quality of Life (QoL).

BT: Brachytherapy; RALP: Robot Assisted Laparoscopic Prostatectomy; AS: AS; SD: Standard Deviation; PR domain 1: voiding complaints; PR domain 2: use of incontinence aids; PR domain 3: bowel complaints; PR domain 4: metabolic and endocrinological effects; PR domain 5: sexual activity; PR domain 6: sexual functioning; IIEF-15: overall sexual function; IIEF-EF: erectile function; IIEF-OF: orgasmic function; IIEF-SD: sexual desire; IIEF-IS: intercourse satisfaction; IIEF-OS: overall satisfaction; ICIQ-SF-total: domain of severity of urine incontinence and quality of life; QLQ-C30 domain 15: Overall quality of life according to the EORTC-C30 questionnaire.

Comparison of Baseline QoL measures with follow-up QoL.
The QoL scores are recoded so that 100% reflects the highest and best QoL score and 0% the lowest score. The column % difference shows the % change of QoL score at follow up (improved QoL score in bold)
Patients with localized prostate cancer in the NKI-AvL Hospital database (n = 2615)

Selection of patients with BT/RALP/AS:
Total (n = 1523)
- BT: n = 298
- RALP: n = 962
- AS: n = 263

Data: Total (n = 614)
- BT: n = 144
- RALP: n = 345
- AS: n = 125

Data: Total (n = 200)
- BT: n = 36
- RALP: n = 86
- AS: n = 78

Data for analysis:
Total (n = 144)
- BT: n = 29
- RALP: n = 65
- AS: n = 50

Other therapy than BT, RALP, AS (n = 1092)

Excluded (Total = 909)
- BT: n = 154
- RALP: n = 617
- AS: n = 138
Exclusion because of incomplete questionnaires (n=68), no baseline questionnaires (n=350), no follow-up questionnaires (n=491)

Excluded: Total (n = 414)
- BT: n = 108
- RALP: n = 259
- AS: n = 47
Exclusion because of Gleason score, cT-stage, iPSA, number of positive biopsies

Excluded: Total (n=56)
- BT: n = 7
- RALP: n = 21
- AS: n = 28
Exclusion because of follow-up < 1 year

Flow chart of patient selection of the NKI-AvL prostate database
Differences (%) in QoL outcome among three treatment groups for each QoL domain. The difference (%) is indicated by decline or by improvement of QoL (X axis). ( ) indicates significant differences of each treatment group per QoL domain.

RALP: Robotic Assisted Laparoscopic Prostatectomy; BT: Brachytherapy; QoL-C30 domain 15; overall quality of life; ICIQ-SF: domain of severity of lower urinary incontinence; IIEF-SD: sexual desire; IIEF-OS: overall satisfaction; IIEF-15; overall sexual function; PR domain 5: erectile function; PR domain 6: sexual functioning; PR domain 4: micturition, bowel and sexual complaints; PR domain 3: voiding complaints.