Prostate CyberKnife Stereotactic Body Radiotherapy: Report on the Early Experience at a Community-based CyberKnife Center

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OBJECTIVE

To review the prostate CyberKnife Stereotactic Body Radiotherapy (SBRT) first year experience at Reno CyberKnife. Specifically, PSA responses and toxicity are evaluated.

METHODS

A retrospective review and analysis of the first 37 patients treated during the first year at Reno CyberKnife (10/24/08-10/23/09) was performed. These patients had a minimum of 12 months of follow-up. Nine patients were excluded from analysis because of the use of androgen deprivation or previous therapy with cryotherapy or conventional external beam radiotherapy. Twenty-eight patients treated with the CyberKnife robotic radiosurgical system were available for this analysis. For every patient, 4 gold fiducials were inserted transperineally for fiducial tracking, and MRI and CT were fused for treatment planning. Most patients received a total dose of 36.25 Gy in 5 fractions within a 7 day period. Two patients with high risk disease were treated with 3 fractions of 7 Gy in combination with conventionally fractionated pelvic radiotherapy. Twenty-eight patients treated with the CyberKnife robotic radiosurgical system were available for this analysis. For every patient, 4 gold fiducials were inserted transperineally for fiducial tracking, and MRI and CT were fused for treatment planning. Most patients received a total dose of 36.25 Gy in 5 fractions within a 7 day period. Two patients with high risk disease were treated with 3 fractions of 7 Gy in combination with conventionally fractionated pelvic radiotherapy, 45 Gy in 25 treatments over 5 weeks. The dose was prescribed to cover at least 95% of the Planning Target Volume (PTV) which was defined as the Clinical Target Volume (CTV) plus 5 mm in all directions except posteriorly, where the margin was 3 mm. The CTV was defined as the prostate +/- the seminal vesicles, depending on risk characteristics. Median number of beams used and isodose line prescribed are 140 beams and 83%. In most cases, treatment started on a Wednesday or Thursday, and completed the following Tuesday or Wednesday, providing an inherent weekend break during the course of therapy. PSA's were monitored at 4-6 weeks following treatment and every 3 months in the first year of follow-up. Toxicity was assessed according to the Common Terminology Criteria for Adverse Events (CTCAE), version 3, at each follow-up visit.

RESULTS: PATIENT CHARACTERISTICS

Age, median 67 (range, 57-75)
PSA, median 5.75 ng/mL (range, 1.5-14.1)
Gleason Sum
3+3=6 11
3+4=7 6
4+3=7 8
4+4=8 2
4+5=9 1
Clinical Stage (AJCC, 6th ed.)
T1b 1
T1c 18
T2a 6
T2b 1
T3a 2
NCCN Risk Group
Low 10
Interm. 15
High 3

RESULTS: PSA TREND

Median PSA ng/mL

<table>
<thead>
<tr>
<th>Time</th>
<th>PSA</th>
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<tbody>
<tr>
<td>Initial</td>
<td>8.0</td>
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<tr>
<td>6-8 weeks</td>
<td>7.0</td>
</tr>
<tr>
<td>3 months</td>
<td>6.0</td>
</tr>
<tr>
<td>6 months</td>
<td>5.0</td>
</tr>
<tr>
<td>9 months</td>
<td>4.0</td>
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<tr>
<td>12 months</td>
<td>3.0</td>
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</tbody>
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Two patients had erratic PSA's with 1 year PSA of 5.36 and 5.7 ng/mL, and met the nadir +2 definition of biochemical failure. Subsequent PSA's in these 2 patients are trending lower.

RESULTS: TOXICITY

<table>
<thead>
<tr>
<th>Site</th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
<th>Grade 4</th>
<th>Grade 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>GI</td>
<td>3(10)</td>
<td>1(4)</td>
<td>0(0)</td>
<td>0(0)</td>
<td>0(0)</td>
</tr>
<tr>
<td>GU</td>
<td>12(43)</td>
<td>3(11)</td>
<td>3(10)*</td>
<td>0(0)</td>
<td>0(0)</td>
</tr>
</tbody>
</table>

*Three Patients experienced urinary obstruction requiring catheterization at 9 months. One patient underwent TURP and had significant healing difficulties, but improved with hyperbaric oxygen therapy

CONCLUSIONS

CyberKnife SBRT for localized prostate cancer shows promising early PSA responses and is well tolerated by the majority of patients, although we note 3 incidents of grade 3 urinary toxicity at 9 months.