The Wellness Community
Prostate Cancer

Large Discussion Group

July 28, 2010

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Knowledge Navigator
Tonight’s Agenda

• Review peer reviewed information on proton therapy for prostate cancer treatment (60 min)
• Member’s Q & A and panel discussion of the proton therapy experience (30 min)
What is Proton Therapy?

• Proton therapy is a type of external beam radiation therapy (EBRT)

• The promoted advantage of proton therapy is the ability to more precisely localize the radiation dosage when compared with other types of EBRT

• The development of proton therapy began in the 1950s at accelerator laboratories, and in the last 20 years has expanded to hospital based facilities
How Does it Work?

• A particle accelerator is used to target the tumor with a beam of charged particles called protons

• The charged particles damage the cell’s DNA, causing cell death or interfering with the cell’s ability to reproduce

• Cancer cells have a high rate of division and reduced ability to repair damaged DNA, making radiation therapy effective
Protons

- Protons are large particles with a positive charge that penetrate tissue to a finite depth based on the energy of the beam.
- Due to their relatively large mass, protons have little lateral side scatter in the tissue.
- The beam does not broaden much and stays focused on the target.
- Proton therapy should protect surrounding tissue by limiting dose side-effect.
Proton Application

• To treat tumors at greater depths, the proton accelerator must produce a beam with higher energy.

• Proton beam energy is adjusted during treatment to attempt to maximize cell damage within the tumor.

• Tissues closer to the surface of the body than the tumor receive reduced radiation and beyond the target very little.

• Passive beam scattering and modulation are required to cover prostate gland and may spread radiation dose outside the target area.
History

- Robert Wilson published research paper in 1946
- First treatments performed at particle accelerators built for physics research
- The first treatments on humans in 1950’s consisted of irradiation to destroy the pituitary gland in patients with metastatic breast cancer
- The Loma Linda University (CA) Medical Center was built in 1990 and began treating prostate cancer patients
Application to PCa

• Increased precision of proton therapy attempts to reduce unwanted side effects by confining radiation dose to the tumor

• Tumor dose same as conventional radiation therapy thus no expectation of an increased probability of cure

• Emphasis is on the reduction of unwanted side effects
Treatment Process

- Complete preliminary CT scans
- Insert fiducial marker for positioning
- Prepare immobilization cradle
- Complete planning CT scan
- Prepare treatment plan (typically 44 doses)
- Develop beam shaping devices
- Verify simulation
- Begin daily treatment (5 days/wk) for 9 weeks
Daily Treatment

• Patient arrives early, drinks water to fill bladder, and puts on gown
• Patient positioned on treatment table in body cradle
• Balloon inserted in rectum and filled with water to position gland and limit movement
• Robotic arm guides table into position
• X-rays performed to check table alignment and adjust positioning (not used for treatment)
• Proton beam delivered for approximately 45-60 seconds per field
• If multiple fields - do again (time 20 – 30 min.)
Treatment Efficacy

• Loma Linda 2004 Study of 1255 men between 1991 and 1997
• Patient ages from 44 – 90, median 69
• 29% stage T1
• 67% stage T2
• 4% stage T3
• Initial PSA 0 to 4 - 9%
• 4.1 to 10 – 51%
• 10.1 to 20 – 29%,
• > 20 – 11%
• Gleason 2 to 4 – 18%, 5 to 7 – 75%, 8 to 10 – 7%
Loma Linda 2004 Results

• Overall 5-year biochemical disease free survival rate = 75%
• Overall 8-year biochemical disease free survival rate = 73%
• If pretreatment PSA < 4, 10-yr survival rate 90%
• If PSA between 4.1 – 10, 10-yr survival rate 84%
• If PSA between 10.1 – 20, 10-yr survival rate 65%
• If PSA > 20, 10-yr survival rate 48%
Loma Linda 2004 Results (cont’d)

- If Gleason 2 – 4, 10-yr survival rate 82%
- If Gleason 5 – 7, 10-yr survival rate 73%
- If Gleason 8 – 10, 10-yr survival rate 50%
- If PSA nadir < 0.51, 10-yr survival rate 87%
- If PSA nadir 0.51 – 1.0, 10-yr survival rate 69%
- If PSA nadir > 1.0, 10-yr survival rate 25%
Comparative 10-Yr Results with Other Popular Treatment Options

<table>
<thead>
<tr>
<th>Gleason Score</th>
<th>Proton Therapy</th>
<th>Radical Prostatectomy</th>
<th>Brachy-Therapy (Seeds)</th>
<th>IMRT Radiation</th>
<th>Combination Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - 4</td>
<td>82%</td>
<td>78%</td>
<td>80%</td>
<td>85%</td>
<td>90%</td>
</tr>
<tr>
<td>5 - 6</td>
<td>73%</td>
<td>73%</td>
<td>72%</td>
<td>76%</td>
<td>90%</td>
</tr>
<tr>
<td>7 - 8</td>
<td>69%</td>
<td>68%</td>
<td>66%</td>
<td>72%</td>
<td>89%</td>
</tr>
<tr>
<td>9 - 10</td>
<td>50%</td>
<td>56%</td>
<td>47%</td>
<td>67%</td>
<td>74%</td>
</tr>
</tbody>
</table>
Loma Linda 2004 Side Effects

• In general, proton therapy well tolerated
• Late gastrointestinal (GI) toxicity included pain and bleeding in 2 patients, and a bowel obstruction required colostomy in 1 patient
• 14 patients developed late genitourinary (GU) toxicity, 8 with urethral strictures, 4 with hematuria, 2 with dysuria
• Overall side effects about 1%
### Long-Term Complications

<table>
<thead>
<tr>
<th>Chronic Toxicity</th>
<th>Proton Therapy</th>
<th>IMRT Radiotherapy</th>
<th>Radical Prostatectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impotence</td>
<td>30%</td>
<td>49%</td>
<td>62%</td>
</tr>
<tr>
<td>Incontinence (requiring pad)</td>
<td>1%</td>
<td>1.5%</td>
<td>56%</td>
</tr>
<tr>
<td>Bladder Neck Contracture</td>
<td>0%</td>
<td>3%</td>
<td>8%</td>
</tr>
<tr>
<td>Chronic Cystitis</td>
<td>0.4%</td>
<td>3%</td>
<td>N/A</td>
</tr>
<tr>
<td>Difficult or Painful Urination</td>
<td>1%</td>
<td>2%</td>
<td>36%</td>
</tr>
<tr>
<td>Rectal Bleeding</td>
<td>1%</td>
<td>1.6%</td>
<td>N/A</td>
</tr>
<tr>
<td>Rectal Stricture</td>
<td>0%</td>
<td>0.5%</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Proton Advantages

- Treatment results are comparable to the best radical prostatectomy (RP) results
- Side effects are significantly reduced compared to RP and slightly less than other radiation treatment options
- Treatment is non-invasive (other than balloon!) and relatively painless
- There is minimal toxicity associated with treatment of prostate cancer with protons
Proton Disadvantages

- Limited treatment centers available in US (7) and fairly long treatment schedule (44 daily treatments)
- Risk of scatter when treating a large area like the prostate with a narrow pencil shaped beam
- Possible long-term risk of secondary cancers due to neutron scattering
- Organs may move during treatment causing inadequate treatment dosage or side effects
- Expensive treatment option (average $58,610 vs. $25,846 for IMRT) and some insurers may not cover
- Limited studies available for proton treatment compared directly against photons
- Possibly inferior treatment for intermediate and high risk cancers compared to other radiation therapies
Proton Centers

• Loma Linda University Medical Center Loma Linda, CA 92350
  Phone: 1-800-PROTONS to request a consultation
• Francis H. Burr Proton Center Massachusetts General Hospital Boston, Massachusetts
  Adult Oncology 1-877-726-5130 or 617-726-5130
• Midwest Proton Radiotherapy Institute Indiana University
  Bloomington, IN 47408 1-866-ITS-MPRI (866-487-6774)
• M. D. Anderson Cancer Center University of Texas Houston, TX
  1-866-632-4PTC (4782) for information and referrals
• University of Florida Proton Therapy Institute Shands Campus
  in Jacksonville, FL (877) 686-6009
• ProCure Proton Therapy Center Oklahoma City, Oklahoma (888)
  847-2640
• The Roberts Proton Therapy Center at the University of PA
  (800) 789-PENN (7366)
Proton Panel Discussion

• Q & A

• Open a panel discussion with men who have proton therapy experience they wish to share with others
My Contact Info

If you want a copy of this presentation contact me (preferably via email) at:

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