Eine Diskussion in der medphys-list über die "richtige" Strahlenergie für IMRT

Beiträge zwischen 25. 3. und 28. 3. 2002

Dear Members,

I would like to know if there is a concensus growing among physicsts as to the optimum energy to use for IMRT treatments of the prostate.

I have heard several speakers advocate 6 MV for IMRT treatments to all sites but I would like to know what is actually being used "out in the field".

Please share your experiences, rationale, etc.

If you choose to respond privately, I will summarize for the list.

Thanks in advance.
Joan Seibert, M.S.
Overlook Hospital
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Dear Joan,

Friday we had a meeting in Hamburg/FRG and discussed that. I was told by a NOMOS supervisor (some years ago), that there is a consensus: 6MV "are enough". For higher energies I can also see problems eg in the nasopharynx region with the range of secondary electrons (and new buildup etc). But I don´t know up to now, how many users are satisfied with 6MV and how many also take higher (or lower ?) energies and I´m interested to hear some numbers ! We use only 6MV !

Werner FO Schmidt
Donauspital Vienna
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Dear Joan,

I think there may be multiple issues related to your question. I agree with Werner and we would avoid treating a nasopharynx with energies higher than 6 MV, but since you asked specifically about prostate treatment I will put my 2 cents in. The dose distribution in the region of the prostate, rectum, and bladder interface will be very similar regardless of the energy you choose (ie. 6, 10, 18 MV).

However, if you are using a sMLC delivery technique as we do, then you have to be conscious of the dose deposited along the individual "beam paths". While your target coverage and rectal sparing may look great, if you treat to 80Gy with 6 MV and have 80 and 90% high dose regions in overlying bowel you may run into trouble. One solution is to add additional beam directions. This spreads the dose out but brings up a second problem, treatment time. More beam directions generally mean more segments and subsequently more treatment time. Additionally, we treat using Siemens Primus units and our 6MV beams run at a lower dose rate than 10 or 18MV (300vs 500MU/min).

Higher energies translate directly into lower treatment times at our center. At 18MV (in our case) you may need to consider the increased neutron component of the beam. We have chosen to treat with IMRT with 6 or 10 MV only. We treat approximately 60 IMRTpatients per day with an approximately even distribution of 6 and 10MV for prostate patients. This is purely logistical. If it were possible we would definitely treat with 10MV exclusively (baring in mind our step-and-shoot approach and patient load).

I hope this helps

Robert A. Price Jr., Ph.D., DABR
Medical Physicist,
Department of Radiation Oncology
Fox Chase Cancer Center
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Robert,

According to our estimation, performing an IMRT treatment on a prostate patient at 18 MV combined with In-Situ Activation Radiation Therapy (TM)(or InSituART, previously called In-Situ Activation Brachytherapy) may reduce the treatment time from 5weeks to about a week. InSituART uses the neutrons already in the beam to activate non-radioactive seeds implanted in the tumor.

Nabil Adnani, Ph.D.
NTI Inc.
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We saw a small increase in plan quality when using 10X compared to 6X for our 5 field prostate treatments. 10X also produces virtually no neutrons, so that is also a small improvement over 15X or 18X in terms of staff dose, whole body patient dose, and radiation damage to equipment. None of those are big problems, however.

Gary A. Ezzell, Ph.D.
Mayo Clinic Scottsdale

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IMRT offers an objective evaluation of which is the 'optimal energy'. Calculate IMRT plans at both energies, and choose the one which gives the lowest score. The lowest score plan is that which most closely meetsthe desired treatment objectives.

I surprised myself by performing such an evaluation for a lung plan, and 18 MV gave a better plan than 6 MV (yes I was using a 'decent' dose calculation algorithm).

Paul Keall
Radiation Physics Section
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Beam energy affects penetration, buildup, lateral scattering and neutron dose. If you use a few gantry angles, penetration may be a concern, then you want to use higher energy beam; if you use rotation beams with large gantry angles, penetration is not a concern, IMRT or no IMRT. If you use 18 MV, with IMRT, MU is higher, Neutron dose may be a problem. Some IMRT methods use a lot less MU than others.

For fixed gantry IMRT, Varian sliding window technique dose not use very high MU; for rotational IMRT, 3Dline technique should not use very high MU. For lateral scattering, high intensity near the beam edge would make the beam more flat, but it may also increase dose outside the beam, so low energy beam may be better. With fixed gantry IMRT, sometime one may pick suitable energy to cover or spare superficial structure using different buildup depths.

Tianyou Xue, PhD
Chief Physicist
WVHCS

Wilkes-Barre, PA 18764
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Regarding the energy for prostate treatment using IMRT there was a presentation in AAMP 2000 (MO-EBR-03, World Congress 2000, RadiationTherapy, Chicago): " Feasibility study of using low-energy intensity modulated radiation for the treatment of localized prostate carcinoma to high doses" by X-Q. Lu, C.Burman, B. Mychalczak, A. Hirsch, C-S. Chui, S. A. Leibel, C. C. Ling (Memorial Sloan-Kettering Cancer Center, NY). The point was that "the dose distributions and DVHs with 6 MV x-rays using IMRT techniques were quite acceptable and comparable to those with 15 MV x-rays" and that "for the treatment facilities where there is only a single low energy accelerator, it may be possible to treat patients to higher doses with IMRT".

Xing-Qi Lu
Beth Isreal Deaconess Medical Center
Harvard Medical School
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Does your DVH studies include "Body" as a volume of interest?

"Body" in the language of my TPS means everything inside the skin, which tells what doses given to normal tissues in the path of the beams.

One can argue that such doses are low regardless of energy used, but it is still a point of comparison when Prostate/Rectum/Bladder DVH's does not show major differences for Hi/Lo energies.

Ahmad Al-Ani, M.S.
Medical Physicist
Greater Baltimore Medical Center
Baltimore, Maryland
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Ahmad,

We primarily use the Corvus system for IMRT planning and yes you do get a resultant DVH for "tissue" and "non-target" tissue. However, the DVH gives no spatial information and with everything lumped together you cannot tell which structures are receiving the higher doses (from the DVH alone) unless you outline them. It is possible to outline the small bowel and colon (quite labor intensive), in the prostate case, and evaluate the dose volume relationship. We have chosen to evaluate the individual isodose curves on a slice-by-slice basis and limit the dose along the beam paths, away from the target, to acceptable limits based on the sensitive structures involved. (ie. if small bowel is the limiting structure, assure that no portion receives dose in excess of your clinical limits). Of course you need to restrict your dose distribution to account for potential organ position variation when possible.

Bob

Robert A. Price Jr., Ph.D., DABR
Medical Physicist
Department of Radiation Oncology
Fox Chase Cancer Center
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I saw a reference to 18MV lung plans as this discussion progressed. I thought IMRT was strongly discouraged for lung because of higher integral dose to the untreated portion of the lungs, breathing motion and because of some remaining question of dose modeling accuracy at large inhomogeneity boundaries. Is this no longer the case?

Chuck Smith