Evaluation of Normal Tissue Complication Probability and Risk of Second Primary Cancer in Prostate Radiotherapy

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Bibliography

- Abdel-Wahab M, Reis IM, Hamilton K. Second primary cancer after radiotherapy for prostate cancer - a SEER analysis of brachytherapy versus external beam radiotherapy. *International Journal of Radiation Oncology Biology Physics* 2008; 72: 58 - 68.
- 2. AIHW, AACR. Cancer in Australia: an overview, 2008. Canberra: Australian Institute of Health and Welfare & Australasian Association of Cancer Registries; 2008.
- 3. Akimoto T, Katoh H, Noda S-E, *et al.* Acute genitourinary toxicity after high dose rate (HDR) brachytherapy combined with hypofractionated external-beam radiation therapy for localized prostate cancer: Second analysis to determine the correlation between the urethral dose in HDR brachytherapy and the severity of acute genitourinary toxicity. *International Journal of Radiation Oncology Biology Physics* 2005; **63**: 472 478.
- Akimoto T, Muramatsu H, Takahashi M, *et al.* Rectal bleeding after hypofractionated radiotherapy for prostate cancer: Correlation between clinical and dosimetric parameters and the incidence of grade 2 or worse rectal bleeding. *International Journal of Radiation Oncology Biology Physics* 2004; 60: 1033 - 1039.
- Amer AM, Mott J, Mackay RI, *et al.* Prediction of the benefits from dose-escalated hypofractionated intensity-modulated radiotherapy for prostate cancer.
 International Journal of Radiation Oncology Biology Physics 2003; 56: 199 207.
- 6. Anderson CM, Mahadevan A, Reddy C, *et al.* External beam radiation dose response and toxicity in low-risk prostate cancer. *International Journal of Radiation Oncology Biology Physics* 2005; **63**: S318.
- Aoyama H, Westerly DC, Mackie TR, *et al.* Integral radiation dose to normal structures with conformal external beam radiation. *International Journal of Radiation Oncology Biology Physics* 2006; 64: 962 - 967.

- Ares C, Popowski Y, Molla M, *et al.* Hypofractionated boost in prostate cancer radiotherapy as part of two different dose escalation strategies, HDR brachytherapy or IMRT: A late rectal toxicity assessment. *International Journal of Radiation Oncology Biology Physics* 2004; 60: S477 - S478.
- Ashman JB, Zelefsky MJ, Hunter MS, *et al.* Whole pelvic radiotherapy for prostate cancer using 3D conformal and intensity-modulated radiotherapy. *International Journal of Radiation Oncology Biology Physics* 2005; 63: 765 771.
- 10. Astrom L, Pedersen D, Mercke C, *et al.* Long-term outcome of high dose rate brachytherapy in radiotherapy for localized prostate cancer. *Radiotherapy and Oncology* 2005; **74**: 157 - 161.
- Aus G, Abbou CC, Bolla M, *et al.* EAU guidelines on prostate cancer. *European Urology* 2005; **48**: 546 - 551.
- Barendsen GW. Dose fractionation, dose rate and isoeffect relationships for normal tissue response. *International Journal of Radiation Oncology Biology Physics* 1982;
 8: 188 197.
- Barquero R, Mendez R, Iniguez MP, *et al.* Thermoluminescence measurements of neutron dose around a medical linac. *Radiation Protection Dosimetry* 2002; **101**: 493 - 496.
- Battermann JJ, Boon TA, Moerland MA. Results of permanent prostate
 brachytherapy, 13 years of experience at a single institution. *Radiotherapy and Oncology* 2004; **71**: 23 28.
- Baxter NN, Tepper JE, Durham SB, *et al.* Increased risk of rectal cancer after prostate radiation: a population-based study. *Gastroenterology* 2005; **128**: 819 -824.
- Begg CB, Riedel ER, Bach PB, et al. Variations in morbidity after radical prostatectomy. *The New England Journal of Medicine* 2002; **346**: 1138 - 1144.
- Ben-Amar G, Ben-Shachar B, Oster L, *et al.* Investigation of the glow peak parameters, reusability and dosimetric precision of LiF:Mg,Cu,P at high heating rate up to 20 K.s⁻¹. *Radiation Protection Dosimetry* 1999; **84**: 235 - 238.

- Bentzen SM. Dose-response relationships in radiotherapy. In: Steel GG, editor. Basic Clinical Radiobiology. London: Arnold Publishers; 2002. pp. 94 - 104.
- 19. Beyer DC, Brachman DG. Failure free survival following brachytherapy alone for prostate cancer: comparison with external beam radiotherapy. *Radiotherapy and Oncology* 2000; **57**: 263 267.
- Bishop DT. The epidemiology of prostate cancer. In: Abel PD, Lalani E-N, editors.
 Prostate cancer: clinical and scientific aspects bridging the gap. London: Imperial
 College Press; 2003.
- Blasko JC, Grimm PD, Sylvester JE, *et al.* Palladium-103 brachytherapy for prostate carcinoma. *International Journal of Radiation Oncology Biology Physics* 2000; 46: 839 850.
- 22. Bonta DV, Fontenia E, Lu Y, *et al.* A variable critical-volume model for normal tissue complication probability. *Medical Physics* 2001; **28**: 1338 1343.
- Boon SN. Dosimetry and quality control of scanning proton beams. Faculty of Mathematics and Natural sciences. Vol Ph.D. Groningen, Netherland: University of Groningen; 1998. p. 169.
- Borghede G, Hedelin H. Radiotherapy of localised prostate cancer. Analysis of late treatment complications: a prospective study. *Radiotherapy and Oncology* 1997; 43: 139 146.
- Boyea G, Martinez A, Wallace M, et al. High dose rate (HDR) prostate boost
 brachytherapy: A comparison of acute and chronic toxicities between three dose
 escalation groups. International Journal of Radiation Oncology Biology Physics 2005;
 63: S188.
- Brabbins D, Martinez A, Yan D, *et al.* A dose-escalation trial with the adaptive radiotherapy process as a delivery system in localized prostate cancer: Analysis of chronic toxicity. *International Journal of Radiation Oncology Biology Physics* 2005;
 61: 400 408.
- 27. Brenner DJ. Toward optional external-beam fractionation for prostate cancer.

International Journal of Radiation Oncology Biology Physics 2000; 48: 315 - 316.

- Brenner DJ. Hypofractionation for prostate cancer radiotherapy what are the issues? *International Journal of Radiation Oncology Biology Physics* 2003; 57: 912 914.
- Brenner DJ. Induced second cancers after prostate cancer radiotherapy: no cause for concern? *International Journal of Radiation Oncology Biology Physics* 2006; 65: 637 639.
- 30. Brenner DJ, Curtis RE, Hall EJ, *et al.* Second malignancies in prostate carcinoma patients after radiotherapy compared with surgery. *Cancer* 2000; **88**: 398 406.
- 31. Brenner DJ, Martinez AA, Edmundson GK, *et al.* Direct evidence that prostate tumors show high sensitivity to fractionation (low α / β ratio), similar to late-responding normal tissue. *International Journal of Radiation Oncology Biology Physics* 2002; **52**: 6 13.
- Buffa FM, Fenwick JD, Nahum AE. An analysis of the relationship between radiosensitivity and volume effects in tumor control probability modeling. *Medical Physics* 2000; 27: 1258 - 1265.
- Burman C, Kutcher GJ, Emami B, *et al.* Fitting of normal tissue tolerance data to an analytic function. *International Journal of Radiation Oncology Biology Physics* 1991;
 21: 123 135.
- Butler W, Merrick G, Wallner K, et al. Prostate brachytherapy-induced urethral stricture. International Journal of Radiation Oncology Biology Physics 2005; 63: S299.
- 35. Butson MJ, Cheung T, Yu PKN. Peripheral dose measurement with a MOSFET detector. *Applied Radiation and Isotopes* 2005; **62**: 631 634.
- Cahan WG, Woodward HQ, Higgenbotham NL, *et al.* Sarcoma arising in irradiated bone: Report of eleven cases. *Cancer* 1948; 1: 382 - 384.
- 37.Carinou E, Stamatelatos IE, Kamenopoulou V, et al. An MCNP-based model for the
evaluation of the photoneutrondose in high energy medical electron

accelerators. *Physica Medica* 2005; **21**: 95 - 99.

- Cember H. Chapter 5. Interaction of radiation with matter. In: Introduction to health physics. 3rd ed. New York: McGraw-Hill Professional; 1996.
- Cesaretti JA, Stone NN, Stock RG. Urinary symptom flare following I-125 prostate brachytherapy. *International Journal of Radiation Oncology Biology Physics* 2003; 56: 1085 - 1092.
- 40. Chandan VS, Wolsh L. Postirradiation angiosarcoma of the prostate. *Archives of Pathology and Laboratory Medicine* 2003; **127**: 876 878.
- 41. Chen CC, Sheu RJ, Yeh CY, *et al.* A detailed study on the neutron contamination for a 10 MeV medical electron accelerator. *Nuclear Instruments and Methods in Physics Research A* 2006; **562**: 1033 1037.
- 42. Chibani O, Ma C-MC. Photonuclear dose calculations for high-energy photon beams for Siemens and Varian linacs. *Medical Physics* 2003; **30**: 1990 2000.
- 43. Chrouser K, Leibovich B, Zincke H, *et al.* Bladder cancer risk following primary and adjuvant external beam radiation for prostate cancer. *Journal of Urology* 2005; **174**: 107 110.
- 44. Ciezki JP, Reddy CA, Garcia J, *et al.* PSA kinetics after prostate brachytherapy: PSA bounce phenomenon and its implications for PSA doubling time. *International Journal of Radiation Oncology Biology Physics* 2006; 64: 512 517.
- 45. Collie AC, Buskirk SJ, Wehle MJ, *et al.* Evaluation of chronic toxicity following radiation therapy for patients with a rising PSA status post prostatectomy. *International Journal of Radiation Oncology Biology Physics* 2004; **60**: S478.
- 46. Cooperberg MR, Moul JW, Carroll PR. The changing face of prostate cancer. *Journal of Clinical Oncology* 2005; **23**: 8146 8151.
- 47. Corner C, Rojas AM, Bryant L, *et al.* A phase II study of high-dose-rate afterloading brachytherapy as monotherapy for the treatment of localized prostate cancer *International Journal of Radiation Oncology Biology Physics* 2008; **72**: 441 446.

- 48. Cozzi L, Buffa FM, Fogliata A. Comparative analysis of dose volume histogram reduction algorithms for normal tissue complication probability calculations. *Acta Oncologica* 2000; **39**: 165 - 171.
- 49. Dale RG. The application of the linear-quadratic dose-effect equation of fractionated and protracted radiotherapy. *The British Journal of Radiology* 1985; **58**.
- 50. Dasu A. Is the α / β value for prostate tumours low enough to be safely used in clinical trials? *Clinical Oncology* 2007; **19**: 289 301.
- 51. Dasu A, Toma-Dasu I. Dose-effect models for risk-relationship to cell survival parameters. *Acta Oncologica* 2005; **44**: 829 835.
- 52. Dasu A, Toma-Dasu I, Olofsson J, *et al.* The use of risk estimation models for the induction of secondary cancers following radiotherapy. *Acta Oncologica* 2005; 44: 339 347.
- Dattori MJ, Wallner K, True L, *et al.* Long-term prostate cancer control (13 year actuarial) in patients with a high likelihood of extracapsular cancer extension using Pd-103 brachytherapy and supplemental beam radiation. *International Journal of Radiation Oncology Biology Physics* 2005; 63: S298.
- 54. Dearnaley DP, Khoo VS, Norman AR, *et al.* Comparison of radiation side-effects of conformal and conventional radiotherapy in prostate cancer: a randomized trial. *The Lancet* 1999; **353**: 267 272.
- 55. Dearnaley DP, Khoo VS, Norman AR, *et al.* Comparison of radiation side-effects of conformal and conventional radiotherapy in prostate cancer: a randomised trial. *The Lancet* 1999; **353**: 267 271.
- 56. Demanes DJ, Altieri GA, Brandt D, *et al.* Long term results of high dose rate brachytherapy and external beam with and without androgen suppression for prostate cancer. *International Journal of Radiation Oncology Biology Physics* 2005; 63: S38.
- 57. Demanes DJ, Gilhezan M, Schour L, *et al.* High dose rate brachytherapy (HDR-BT) as monotherapy for favorable prostate cancer: excellent 5-year control rates and low toxicity *International Journal of Radiation Oncology Biology Physics* 2008; **69**: S83.

- 58. Demanes JD, Rodriguez RR, Schour L, *et al.* High-dose rate intensity-modulated brachytherapy with external beam radiotherapy for prostate cancer: California endocurietherapy's 10-year results. *International Journal of Radiation Oncology Biology Physics* 2005; **61**: 1306 - 1316.
- 59. DeMeerleer GO, Vakaet LAML, De Gersem WRT, *et al.* Radiotherapy for prostate cancer with or without intensity modulated beams: a planning comparison.
 International Journal of Radiation Oncology Biology Physics 2000; **47**: 639 648.
- d'Errico F, Nath R, Tana L, *et al.* In-phantom dosimetry and spectrometry of photoneutrons from an 18 MV linear accelerator. *Medical Physics* 1998; 25: 1717 1724.
- 61. Dinges S, Deger S, Koswig S, *et al.* High-dose rate interstitial with external beam irradiation for localized prostate cancer results of a prospective trial. *Radiotherapy and Oncology* 1998; **48**: 197 202.
- 62. Dorr W, Herrmann T. Second primary tumours after radiotherapy for malignancies. *Strahlentherapie und Onkologie* 2002; **178**: 357 362.
- 63. Dorr W, Herrmann T. Cancer induction by radiotherapy: dose dependence and spatial relationship to irradiated volume. *Journal of Radiological Protection* 2002;
 22: A117 A121.
- 64. Dorr W, Herrmann T. Second tumors after oncologic treatment. *Strahlentherapie und Onkologie* 2008; **184**: 67 72.
- Emami B, Lyman JT, Brown A, *et al.* Tolerance of normal tissue to therapeutic irradiation. *International Journal of Radiation Oncology Biology Physics* 1991; 21: 109 122.
- Eulau SM, van Hollebeke L, Cavanagh W, *et al.* High dose rate ¹⁹²Iridium
 brachytherapy in localized prostate cancer: Results and toxicity with maximum
 follow-up of 10 years. *International Journal of Radiation Oncology Biology Physics* 2000; 48: S149.
- 67. Facure A, Falcao RC, Silva AXD, *et al.* A study of neutron spectra from medical linear accelerators. *Applied Radiation and Isotopes* 2005; **62**: 69 72.

- 68. Feigenberg SJ, Lee RW, Desilvio ML, *et al.* Health-related quality of life in men receiving prostate brachytherapy on RTOG 98-05. *International Journal of Radiation Oncology Biology Physics* 2005; **62**: 956 - 964.
- 69. Fernandez F, Domingo C, Amgarou K, *et al.* Neutron measurements in a Varian
 2100C linac facility using a Bonner sphere system based on passive gold activation
 detectors. *Radiation Protection Dosimetry* 2007; **126**: 361 365.
- Fowler JF, Ritter MA, Chappel RJ, *et al.* What hypofractionated protocols should be tested for prostate cancer? *International Journal of Radiation Oncology Biology Physics* 2003; **56**: 1093 1104.
- 71. Galalae RM, Kovacs G, Schultze J, *et al.* Long-term outcome after elective irradiation of the pelvic lymphatics and local dose escalation using high-dose-rate brachytherapy for locally advanced prostate cancer. *International Journal of Radiation Oncology Biology Physics* 2002; **52**: 81 90.
- 72. Galalae RM, Martinez A, Mate T, *et al.* Long-term outcome by risk factors using conformal high-dose-rate brachytherapy (HDR-BT) boost with or without neoadjuvant androgen suppression for localized prostate cancer. *International Journal of Radiation Oncology Biology Physics* 2004; **58**: 1048 1055.
- Gershkevitsh E, Rosenberg I, Dearnaley PD, *et al.* Bone marrow doses and leukemia risk in radiotherapy of prostate cancer. *Radiotherapy and Oncology* 1999; 53: 189 197.
- 74. Ghadjar P, Keller T, Rentsch CA, *et al.* Toxicity and early treatment outcomes in lowand intermediate-risk prostate cancer managed by high-dose-rate brachytherapy as a monotherapy. *Brachytherapy* 2009; **8**: 45 - 51.
- 75. Ghilezan M, Vargas C, Gustafson G, *et al.* Similar 5-year clinical outcome for high dose rate (HDR) and low dose rate (LDR) brachytherapy (BT) for early prostate cancer patients. *International Journal of Radiation Oncology Biology Physics* 2005;
 63: S37.
- Giovannucci E, Platz EA. Chapter 2: Epidemiology of prostate cancer. In: VogelzangNJ, Scardino PT, Shipley WU, *et al.*, editors. Comprehensive textbook of

genitourinary oncology. Philadelphia: Lippincott Williams & Wilkins; 2006.

- 77. Gray LH. Radiation biology and cancer. In: Cellular radiation biology: A symposium considering radiation effects in the cell and possible implications for cancer therapy. Baltimore: William & Wilkins; 1965. pp. 8 25.
- Gregori B, Papadopulos S, Cruzate J, *et al.* Multisphere neutron spectrometric system with thermoluminescence dosimeters: sensitive improvement. *Radiation Protection Dosimetry* 2002; **101**: 133 - 136.
- 79. Grills IS, Martinez AA, Hollander M, *et al.* High dose rate brachytherapy as prostate cancer monotherapy reduces toxicity compared to low dose rate palladium seeds. *The Journal of Urology* 2004; **171**: 1098 - 1104.
- Hall EJ. Radiology for the radiologist. Philadelphia: Lippincott Williams & Wilkins;
 2000.
- 81. Hall EJ. Intensity-modulated radiation therapy, protons, and the risk of second cancers. *International Journal of Radiation Oncology Biology Physics* 2006; **65**: 1 7.
- Hall EJ, Wuu C-S. Radiation-induced second cancers: the impact of 3D-CRT and IMRT. *International Journal of Radiation Oncology Biology Physics* 2003; 56: 83 - 88.
- Hanks GE, Schultheiss TE, Hunt MA, *et al.* Factors influencing incidence of acute grade 2 morbidity in conformal and standard radiation treatment of prostate cancer. *International Journal of Radiation Oncology Biology Physics* 1995; **31**: 25 29.
- Harrison RM. Second cancers following radiotherapy: a suggested common dosimetry framework for therapeutic and concomitant exposures. *The British Journal of Radiology* 2004; 77: 986 990.
- 85. Harrison RM, Wilkinson M, Shemilt A, et al. Organ doses from prostate radiotherapy and associated concomitant exposures. *The British Journal of Radiology* 2006; **79**: 487 496.
- 86. Hartford AC, Gladstone DJ, Siegne JD, *et al.* First report on the clinical use of
 Palladium-103 coils: Safety and efficacy in the brachytherapy treatment of early
 stage prostate cancer. *International Journal of Radiation Oncology Biology Physics*

2005; **63**: S319 - S320.

- 87. Holmberg L, Bill-Axelson A, Helgesen F, *et al.* A randomized trial comparing radical prostatectomy with watchful waiting in early prostate cancer. *The New England Journal of Medicine* 2002; **347**.
- Horwitz EM, Vicini FA, Ziaja EL, *et al.* Assessing the variability of outcome for patients treated with localized prostate irradiation using different definitions of biochemical control. *International Journal of Radiation Oncology Biology Physics* 1996; **36**: 565 - 571.
- Howell RM, Ferenci MS, Hertel NE, *et al.* Calculation of effective dose from measurements of secondary neutron spectra and scattered photon dose from dynamic MLC IMRT for 6 MV, 15 MV, and 18 MV beam energies. *Medical Physics* 2006; **33**: 360 - 368.
- 90. Hsu IC, Pickett B, Shinohara K, *et al.* Normal tissue dosimetric comparison between HDR prostate implant boost and conformal external beam radiotherapy boost: potential for dose escalation. *International Journal of Radiation Oncology Biology Physics* 2000; 46: 851 858.
- 91. Huang WL, Li QF, Lin YZ. Calculation of photoneutrons produced in the targets of electron linear accelerators for radiography and radiotherapy applications. *Nuclear Instruments and Methods in Physics Research B* 2005; **229**: 339 347.
- 92. Huguenin PU, Bitterli M, Lutolf UM, *et al.* Localized prostate cancer in elderly patients. *Strahlentherapie und Onkologie* 1999; **175**: 554 558.
- 93. ICRP. ICRP Publication 98: Radiation safety aspects of brachytherapy for prostate cancer using permanently implanted sources. In: Valentin J, editor. Annals of the ICRP. Vol 35: International Commission on radiological Protection; 2005. pp. 37 38.
- 94. ICRU. ICRU Report 13. Neutron fluence, neutron spectra and kerma. In: ICRU, editor. Washington, D.C.: International Commission on Radiation Units and Measurements; 1969.

- 95. Itoh M, Yamada Y, Kiriyama N, *et al.* Neutron activation analysis of low level lithium in water samples. *Journal of Radioanalytical and Nuclear Chemistry* 1993; **172**: 289 298.
- 96. Jackson A, Kutcher GJ, Yorke ED. Probability of radiation-induced complications for normal-tissues with parallel architecture subject to nonuniform irradiation.
 Medical Physics 1993; 20: 613 625.
- 97. Jani AB, Hellman S. Early prostate cancer: clinical decision-making. *The Lancet* 2003; **361**: 1045 1053.
- 98. Jaradat AK, Biggs PJ. Measurement of the neutron leakage from a dedicated intraoperative radiation therapy electron linear accelerator and a conventional linear accelerator. *Medical Physics* 2008; **35**: 1711 - 1717.
- 99. Jones B, Dale RG, Deehan C, *et al.* The role of biologically effective dose (BED) in clinical oncology. *Clinical Oncology* 2001; **13**: 71 81.
- 100. Kallman P, Agren A, Brahme A. Tumour and normal tissue responses to fractionated non-uniform dose delivery. *International Journal of Radiation Biology* 1992; 62: 249 - 262.
- 101. Karlsdottir A, Johannessen DC, Muren LP, *et al.* Acute morbidity related to treatment volume during 3D-conformal radiation therapy for prostate cancer. *Radiotherapy and Oncology* 2004; **71**: 43 - 53.
- 102. Khoo VS. The clinical management of prostate cancer The radiation oncologist's approach and outcomes. In: Abel PD, Lalani E-N, editors. Prostate cancer: Clinical and scientific aspects Bridging the gap. London: Imperial College Press; 2003. pp. 853 909.
- 103. King CR. LDR vs. HDR brachytherapy for localized prostate cancer: the view from radiobiological models. *Brachytherapy* 2002; **1**: 219 226.
- 104. King CR, DiPetrillo TA, Wazer DE. Optimal radiotherapy for prostate cancer: Predictions for conventional external beam, IMRT, and brachytherapy from radiobiologic models. *International Journal of Radiation Oncology Biology Physics* 2000; 46: 165 - 172.

- 105. Kleinerman RA, Liebermann JV, Li FP. Second cancer following cancer of the male genital system in Connecticut, 1935 82. *National Cancer Institute Monograph* 1985; 68: 139 147.
- 106. Kollmeier MA, Stock RG, Stone NN. Biochemical outcomes after prostate brachytherapy with 5-year minimal follow-up: Importance of patient selection and implant quality. *International Journal of Radiation Oncology Biology Physics* 2003; 57: 645 - 653.
- 107. Kry SF, Followill D, White RA, et al. Uncertainty of calculated risk estimates for secondary malignancies after radiotherapy. International Journal of Radiation Oncology Biology Physics 2007; 68: 1265 - 1271.
- 108. Kry SF, Price M, Followill D, *et al.* The use of LiF (TLD-100) as an out-of-field dosimeter. *Journal of Applied Clinical Medical Physics* 2007; **8**: 169 175.
- 109. Kry SF, Salehpour M, Followill DS, *et al.* Out-of-field photon and neutron dose equivalents from step-and-shoot intensity-modulated radiation therapy.
 International Journal of Radiation Oncology Biology Physics 2005; **62**: 1204 1216.
- 110. Kuban D, Pollack A, Huang E, *et al.* Hazards of dose escalation in prostate cancer radiotherapy. *International Journal of Radiation Oncology Biology Physics* 2003; 57: 1260 1268.
- 111. Kuban DA, Tucker SL, Dong L, *et al.* Long-term results of the M.D. Anderson randomized dose-escalation trial for prostate cancer. *International Journal of Radiation Oncology Biology Physics* 2008; **70**: 67 - 74.
- 112. Kupelian PA, Thakkar VV, Khuntia D, *et al.* Hypofractionated intensity-modulated radiotherapy (70 Gy at 2.5 Gy per fraction) for localized prostate cancer: Long-term outcomes. *International Journal of Radiation Oncology Biology Physics* 2005; **63**: 1463 - 1468.
- 113. Kutcher GJ, Burman CM. Calculation of complication probability factors for nonuniform normal tissue irradiation: The effective volume method. *International Journal of Radiation Oncology Biology Physics* 1989; 16: 1623 - 1630.
- 114. Kwa SLS, Lebesque JV, Theuws JCM, *et al.* Radiation pneumonitis as a function of mean lung dose: an analysis of pooled data of 540 patients. *International Journal of*

Radiation Oncology Biology Physics 1998; 42: 1 - 9.

- 115. Landauer. Luxel+ dosimeter for X, gamma, beta, and neutron radiation. IL, USA: Landauer, Inc.; 2005.
- 116. Lanzl LH. The Rando phantom and its medical applications. Chicago, Illinois: The Phantom Laboratory; 1995.
- 117. Lee RW, DeGuzman AF, McMullen KP, *et al.* Dosimetry and cancer control after lowdose-rate prostate brachytherapy. *International Journal of Radiation Oncology Biology Physics* 2005; **61**: 52 - 59.
- 118. Lee RW, Desilvio ML, Lawton C, et al. A phase II study of external beam radiotherapy combined with permanent source brachytherapy for intermediaterisk, clinically localized adenocarcinoma of the prostate: Preliminary results of RTOG P-0019. International Journal of Radiation Oncology Biology Physics 2006; 64: 804 - 809.
- 119. Lee T-K, Allison RR, O'Brien KF, *et al.* Lymphocyte radiosensitivity correlated with pelvic radiotherapy morbidity. *International Journal of Radiation Oncology Biology Physics* 2003; **57**: 222 229.
- 120. Levi F, Randimbison L, Te V-C, *et al.* Second primary tumors after prostate carcinoma. *Cancer* 1999; **86**: 1567 1570.
- 121. Li AX, Wang JZ, Stewart RD, *et al.* Dose escalation in permanent brachytherapy for prostate cancer: dosimetric and biological considerations. *Physics in Medicine and Biology* 2003; **48**: 2753 - 2765.
- 122. Liauw SL, Sylvester JE, Morris CG, *et al.* Second malignancies after prostate brachytherapy: incidence of bladder and colorectal cancers in patients with 15 years of potential follow-up. *International Journal of Radiation Oncology Biology Physics* 2006; **66**: 669 - 673.
- 123. Limbacher AL, Ghilezan M, Gustafson G, *et al.* Impact of age on biochemical control in a cohort of intermediate- and high-risk prostate cancer patients treated with high-dose-rate brachytherapy boost combined with pelvic external beam radiation

therapy Brachytherapy 2009; 8: 174.

- 124. Lin J-P, Chu T-C, Lin S-Y, *et al.* The measurement of photoneutrons in the vicinity of a Siemens Primus linear accelerator. *Applied Radiation and Isotopes* 2001; 55: 315 321.
- 125. Liu JC, Kase KR, Mao XS, *et al.* Calculations of photoneutrons from Varian Clinac accelerators and their transmissions in materials. Radiation Dosimetry and Safety.
 Taipei, Taiwan: SLAC National Accelerator Laboratory; 1997. pp. 1 5.
- 126. Livsey JE, Cowan RA, Wylie JP, *et al.* Hypofractionated conformal radiotherapy in carcinoma of the prostate: Five-year outcome analysis. *International Journal of Radiation Oncology Biology Physics* 2003; **57**: 1254 1259.
- 127. Luxton G, Hancock SL, Boyer AL. Dosimetry and radiobiologic model comparison of IMRT and 3D conformal radiotherapy in treatment of carcinoma of the prostate. *International Journal of Radiation Oncology Biology Physics* 2004; **59**: 267 - 284.
- 128. Luxton G, Keall PJ, King CR. A new formula for normal tissue complication probability (NTCP) as a function of equivalent uniform dose (EUD). *Physics in Medicine and Biology* 2008; **53**: 23 - 36.
- 129. Lyman JT. Complication probability as assessed from dose-volume-histogram.*Radiation Research* 1985; **104**: S13 S19.
- Lyman JT, Wolbarst AB. Optimization of radiation therapy, III: a method of assessing complication probabilities from dose-volume histograms. *International Journal of Radiation Oncology Biology Physics* 1987; 13: 103 - 109.
- 131. MacKay RI, Hendry JH, Moore CJ, *et al.* Predicting late rectal complications following prostate conformal radiotherapy using biologically effective doses and normalized dose-surface histograms. *The British Journal of Radiology* 1997; **70**: 517 526.
- Madsen B, Pham H, Hsi RA, *et al.* Comparison of rectal dose volume histograms for definitive prostate radiotherapy among stereotactic radiotherapy, IMRT, and 3D-CRT techniques. *International Journal of Radiation Oncology Biology Physics* 2004; 60: S633.
- 133. Mahadevan A, Reddy C, Ciezki JP, et al. The prognostic significance of PSA at 6

months after external beam radiation for prostate cancer. *International Journal of Radiation Oncology Biology Physics* 2004; **60**: S459.

- 134. Mangar SA, Huddart RA, Parker CC, *et al.* Technological advances in radiotherapy for the treatment of localised prostate cancer. *European Journal of Cancer* 2005; **41**: 908 921.
- Marcu L, Quach K. The role of post-implant dosimetry in the quality assessment of prostate implants. *Australian Physical & Engineering Sciences in Medicine* 2006; 29: 310 314.
- 136. Mark R, Vallabhan G, Akins A, *et al.* Interstitial high dose rate (HDR) brachytherapy for early stage prostate cancer. *International Journal of Radiation Oncology Biology Physics* 2005; **63**: S304.
- Mark RJ, Anderson PJ, Neumann TR, *et al.* Interstitial high dose rate (HDR)
 brachytherapy as monotherapy for early stage prostate cancer: a report of 254
 cases *International Journal of Radiation Oncology Biology Physics* 2008; **72**: S133.
- Martin T, Baltas D, Kurek R, *et al.* 3-D conformal HDR brachytherapy as monotherapy for localized prostate cancer. *Strahlentherapie und Onkologie* 2004; 180: 225 - 232.
- 139. Martinez A, Yan D, Brabbins D, et al. Dose escalation in prostate cancer: A comparison of RTOG chronic toxicities for patients treated in the adaptive external beam process with 3D-conformal or IMRT vs. external beam plus conformal HDR brachytherapy boost. International Journal of Radiation Oncology Biology Physics 2002; 54: S108 S109.
- Martinez AA, Demanes DJ, Galalae R, *et al.* Ten-year results in 1577
 intermediate/high risk prostate cancer patients treated with external beam
 radiation therapy and hypofractionated high-dose-rate brachytherapy boost
 Brachytherapy 2009; 8: 109.
- 141. Martinez AA, Pataki I, Edmundson G, et al. Phase II prospective study of the use of conformal high-dose-rate brachytherapy as monotherapy for the treatment of favorable stage prostate cancer: A feasibility report. International Journal of Radiation Oncology Biology Physics 2001; 49: 61 - 69.

- Mayer S, Otto T, Golnik N. Determination of the photon-contribution of a ²³⁸Pu–Be source. *Nuclear Instruments and Methods in Physics Research B* 2004; **213**: 214 217.
- McCredie M, Macfarlane GJ, Stewart J, *et al.* Second primary cancer following cancers of kidney and prostate in New South Wales (Australia), 1972 91. *Cancer Causes and Control* 1996; 7: 337 344.
- McElveen TL, Waterman FM, Kim H, et al. Factors predicting for urinary incontinence after prostate brachytherapy. International Journal of Radiation Oncology Biology Physics 2004; 59: 1395 - 1404.
- 145. McKeever SWS, Moskovitch M, Townsend PD. Thermoluminescence dosimetry materials: properties and uses. Kent, England: Nuclear Technology Publishing; 1995.
- Merrick GS, Butler WM, Wallner KE, *et al.* Erectile function after prostate brachytherapy. *International Journal of Radiation Oncology Biology Physics* 2005; 62: 437 - 447.
- 147. Merrick GS, Wallner KE, Butler WM. Minimizing prostate brachytherapy-related morbidity. *Urology* 2003; **62**: 786 792.
- 148. Michalski JM, Kong FM, Mansur DB, *et al.* Quality of life following 3D conformal radiation therapy or permanent interstitial brachytherapy for localized prostate cancer. *International Journal of Radiation Oncology Biology Physics* 2001; **51**: S99.
- 149. Millar JL, Zwahlen DR, Andrianopoulos N, *et al.* Improved prostate cancer control with the use of HDR brachytherapy boost *Brachytherapy* 2008; **7**: 120.
- 150. Miller DC, Montie JE. Chapter 10: Staging systems for prostate cancer. In: Vogelzang NJ, Scardino PT, Shipley WU, *et al.*, editors. Comprehensive textbook of genitourinary oncology. Philadelphia: Lippincott Williams & Wilkins; 2006.
- 151. Miller VA, Reuter V, Scher HI. Primary squamous cell carcinoma of the prostate after radiation seed implantation for adenocarcinoma. *Urology* 1995; **46**: 111 113.
- 152. Mohammadi M. EPID dosimetry in intensity modulated radiation therapy applications. School of Chemistry and Physics. Vol Ph.D. Adelaide: University of

Adelaide; 2006.

- 153. Mohan DS, Kupelian PA, Willoughby TR. Short-course intensity-modulated radiotherapy for localized prostate cancer with daily transabdominal ultrasound localization of the prostate gland. *International Journal of Radiation Oncology Biology Physics* 2000; **46**: 575 - 580.
- 154. Moon K, Stukenberg GJ, Keim J, *et al.* Cancer incidence after localized therapy for prostate cancer. *Cancer* 2006; **107**: 991 998.
- 155. Moss WT, Brand WN, Battifora H. The prostate gland. In: Radiation oncology: rationale, technique, results. Saint Louis: The C.V. Mosby; 1973.
- 156. Movsas B, Hanlon AL, Pinover W, et al. Is there an increased risk of second primaries following prostate irradiation? *International Journal of Radiation Oncology Biology Physics* 1998; **41** 251 - 255.
- 157. Moyers MF, Benton ER, Ghebremedhin A, *et al.* Leakage and scatter radiation from a double scattering based proton beamline. *Medical Physics* 2008; **35**: 128 144.
- 158. Muller A-C, Ganswindt U, Bamberg M, *et al.* Risk of second malignancies after prostate irradiation? *Strahlentherapie und Onkologie* 2007; **183**: 605 609.
- 159. Nag S, Gupta N. A simple method of obtaining equivalent doses for use in HDR brachytherapy. *International Journal of Radiation Oncology Biology Physics* 2000;
 46: 507 513.
- 160. Narayana V, Troyer S, Evans V, et al. Randomized trial of high- and low-source strength ¹²⁵I prostate seed implants. International Journal of Radiation Oncology Biology Physics 2005; 61: 44 - 51.
- 161. Neugut AI, Ahsan H, Robinson E, *et al.* Bladder carcinoma and other second malignancies after radiotherapy for prostate carcinoma. *Cancer* 1997; **79**: 1600 -1604.
- 162. Neumann T, Mark R, Akins A, *et al.* Interstitial high dose rate (HDR) brachytherapy
 + IMRT vs. HDR monotherapy for early stage prostate cancer. *International Journal of Radiation Oncology Biology Physics* 2005; 63: S313 S314.
- 163. Niemierko A, Goitein M. Calculation of normal tissue complication probability and

dose-volume histogram reduction schemes for tissues with a critical element architecture. *Radiotherapy and Oncology* 1991; **20**: 166 - 176.

- 164. Niemierko A, Goitein M. Implementation of a model for estimating tumor control probability for an inhomogeneously irradiated tumor *Radiotherapy and Oncology* 1993; 29: 140 147.
- 165. Niemierko A, Goitein M. Modeling of normal tissue response to radiation: the critical volume model. *International Journal of Radiation Oncology Biology Physics* 1993; 25: 135 145.
- 166. Nilson S, Norlén BJ, Wildmark A. A systematic overview of radiation therapy effects in prostate cancer. *Acta Oncologica* 2004; **43**: 316 381.
- 167. NRC. Technical manual for AN/PDR-70 (Snoopy NP-2) neutron survey meter.Connecticut: Canberra Industries, Inc.; 2003.
- 168. Obryk B, Bilski P, Budzanowski M, *et al.* The response of different types of TL lithium fluoride detectors to high-energy mixed radiation fields. *Radiation Measurements* 2008; **43**: 1144 1148.
- 169. Ongaro C, Zanini A, Nastasi U, *et al.* Analysis of photoneutron spectra produced in medical accelerators. *Physics in Medicine and Biology* 2000; **45**: L55 L61.
- 170. Oster L, Horowitz YS, Horowitz A. Glow curve readout of LiF:Mg,Cu,P (GR-200) chips at maximum temperatures between 240 °C and 280 °C: elimination of the residual signal. *Radiation Protection Dosimetry* 1993; **49**: 407 411.
- 171. Osterlind A, Rorth M, Prener A. Second cancer following cancer of the male genital system in Denmark, 1943 80. *National Cancer Institute Monograph* 1985; 68: 341 347.
- 172. Pawlish KS, Schottenfeld D, Severson R, *et al.* Risk of multiple primary cancers in prostate cancer patients in the Detroit metropolitan area: a retrospective cohort study. *The Prostate* 1997; **33**: 75 86.
- 173. Perez CA, Michalski JM, Purdy JA, *et al.* Three-dimensional conformal therapy or standard irradiation in localized carcinoma of prostate: Preliminary results of a nonrandomized comparison. *International Journal of Radiation Oncology Biology*

Physics 2000; **47**: 629 - 637.

- Peschel RE, Chen Z, Roberts K, *et al.* Long-term Complications with prostate
 implants: Iodine-125 vs. Palladium-103. *Radiation Oncology Investigations* 1999; 7:
 278 288.
- 175. Peters CA, Smith MJ, Stone NN, *et al.* Prostate brachytherapy in twenty-four patients with inflammatory bowel disease. *International Journal of Radiation Oncology Biology Physics* 2005; **63**: S298.
- Phan TP, Puthawala A, Sharma A, *et al.* Treatment of localized prostate cancer with external beam radiation therapy and high dose rate interstitial brachytherapy.
 International Journal of Radiation Oncology Biology Physics 2005; **63**: S315 S316.
- 177. Pickles T, Phillips N. The risk of second malignancy in men with prostate cancer treated with or without radiation in British Columbia, 1984 - 2000. *Radiotherapy and Oncology* 2002; **65**: 145 - 151.
- Pollack A, Hanlon AL, Horwitz EM, *et al.* Dosimetry and preliminary acute toxicity in the first 100 men treated for prostate cancer on a randomized hypofractionation dose escalation trial. *International Journal of Radiation Oncology Biology Physics* 2006; 64: 518 526.
- Pollack A, Smith LG, von Eschenbach AC. External beam radiotherapy dose response characteristics of 1127 men with prostate cancer treated in the PSA era. *International Journal of Radiation Oncology Biology Physics* 2000; **48**: 507 512.
- 180. Pollack A, Zagars GK, Starkschall G, et al. Prostate cancer radiation dose response: results of the M. D. Anderson phase III randomized trial. International Journal of Radiation Oncology Biology Physics 2002; 53: 1097 - 1105.
- 181. Potters L, Morgenstern C, Mullen EE, et al. Twelve year outcomes following permanent brachytherapy in patients with clinically localized prostate cancer. International Journal of Radiation Oncology Biology Physics 2004; 60: S183 - S184.
- Pradhan AS, Bhatt RC. Thermoluminescence response of LiF:Mg,Cu,P and LiF TLD 100 to thermal neutrons, ²⁴¹Am Alphas and gamma rays. *Radiation Protection*

Dosimetry 1989; 27: 185 - 188.

- 183. Purdy JA. Dose to normal tissues outside the radiation therapy patient's treated volume: a review of different radiation therapy techniques. *Health Physics* 2008;
 95: 666 676.
- 184. Raben A, Grebler A, Ivker RA, et al. Patterns and predictors of acute toxicity after HDR brachytherapy and 3D-CRT for localized prostate cancer: Preliminary results of phase I-II dose escalation study. International Journal of Radiation Oncology Biology Physics 2001; 51: S302.
- 185. Ralston AC. An in vivo neutron activation analysis system for cadmium in the human liver and kidney: construction, optimization and calibration. School of Natural and Built Environments. Vol Master of Applied Science (Applied Physics). Adelaide: University of South Australia; 1994.
- 186. Rancati T, Fiorino C, Gagliardi G, et al. Early clinical and radiological pulmonary complications following breast cancer radiation therapy: NTCP fit with four different models. *Radiotherapy and Oncology* 2007; 82: 308 - 316.
- 187. Ray ME, Thames HD, Levy LB, *et al.* PSA nadir predicts biochemical and distant failures after external beam radiotherapy for prostate cancer: A multi-institutional analysis. *International Journal of Radiation Oncology Biology Physics* 2006; 64: 1140 1150.
- 188. Rebello WF, Silva AX, Facure A. Multileaf shielding design against neutrons produced by medical linear accelerator. *Radiation Protection Dosimetry* 2008; **128**: 227 - 233.
- 189. Reft CS, Runkel-Muller R, Myrianthopoulos L. In vivo and phantom measurements of the secondary photon and neutron doses for prostate patients undergoing 18 MV IMRT. *Medical Physics* 2006; **33**: 3734 - 3742.
- 190. Rheingold SR, Neugut AI, Meadows AT. Secondary cancers: incidence, risk factors, and management. Complications of cancer and its treatment. Vol 2006. Atlanta: American Cancer Society; 2003.
- 191. Ron E. Ionizing radiation and cancer risk: evidence and epidemiology. *Radiation Research* 1998; **150**: S30 S41.

- 192. Ruben JD, Davis S, Evans C, *et al.* The effect of intensity-modulated radiotherapy on radiation-induced second malignancies. *International Journal of Radiation Oncology Biology Physics* 2008; **70**: 1530 1536.
- 193. Sanchez-Nieto B, Nahum AE. BIOPLAN: Software for the biological evaluation of radiotherapy treatment plans. *Medical Dosimetry* 2000; **25**: 71 76.
- Sandler HM, Michalski JM. Chapter 13F: 3D conformal radiotherapy for localized prostate cancer. In: Vogelzang NJ, Scardino PT, Shipley WU, *et al.*, editors.
 Comprehensive textbook of genitourinary oncology. Philadelphia: Lippincott Williams & Wilkins; 2006.
- 195. Schmitt HW, Block RC, Bailey RL. Total neutron cross section of B¹⁰ in the thermal neutron energy range. *Nuclear Physics* 1960; **17**: 109 - 115.
- Schneider U, Zwahlen D, Ross D, *et al.* Estimation of radiation-induced cancer from three-dimensional dose distributions: concept of organ equivalent dose.
 International Journal of Radiation Oncology Biology Physics 2005; **61**: 1510 1515.
- Schultheiss TE, Orton CG, Peck RA. Models in radiotherapy: Volume effects. *Medical Physics* 1983; 10: 410 415.
- 198. Semenenko VA, Li XA. Lyman-Kutcher-Burman NTCP model parameters for radiation pneumonitis and xerostomia based on combined analysis of published clinical data. *Physics in Medicine and Biology* 2008; **53**: 737 755.
- 199. Shah JN, Ennis RD. Rectal toxicity profile after transperineal interstitial permanent prostate brachytherapy: Use of a comprehensive toxicity scoring system and identification of rectal dosimetric toxicity predictors. *International Journal of Radiation Oncology Biology Physics* 2006; **64**: 817 824.
- Shahar KH, McGary JE, Mai W, *et al.* Retrospective analysis of late rectal bleeding in prostate cancer patients treated with intensity-modulated radiotherapy (IMRT).
 International Journal of Radiation Oncology Biology Physics 2004; **60**: S459.
- 201. Shipley WU, Scardino PT, Kaufman DS, *et al.* Chapter 13A: Advising patients with early prostate cancer on their treatment decision. In: Vogelzang NJ, Scardino PT,

Shipley WU, *et al.*, editors. Comprehensive textbook of genitourinary oncology. Philadelphia: Lippincott Williams & Wilkins; 2006.

- 202. Shirato H, Mizuta M, Miyasaka K. A mathematical model of the volume effect which postulates cell migration from unirradiated tissues. *Radiotherapy and Oncology* 1995; **35**: 227 231.
- 203. Soto DE, Kempien D, Schipper M, *et al.* Pelvic field size and biochemical failure in the treatment of prostate cancer: a single institution experience. *International Journal of Radiation Oncology Biology Physics* 2005; **63**: S323 S324.
- 204. Springer CD, Boyd RN, Elsdon TC, *et al.* Outcome analysis of HDR prostate brachytherapy in the management of patients with localized prostate cancer in a community cancer center. *Brachytherapy* 2007; **6**: 106.
- Stavrev P, Stavreva N, Niemierko A, et al. Generalization of the normalized doseresponse gradient to non-uniform dose delivery. *Physics in Medicine and Biology* 2001; 46: 1501 - 1518.
- 206. Stavreva N, Stavrev P, Brahme A. Some limitations of the application of the NTCP model describing the response of organs with 'relatively serial' structure. International Journal of Radiation Biology 2002; 78: 948 - 952.
- 207. Steineck G, Helgesen F, Adolfsson J, *et al.* Quality of life after radical prostatectomy or watchful waiting. *The New England Journal of Medicine* 2002; **347**: 790 796.
- 208. Stock RG, Cahlon O, Cesaretti JA, et al. Combined modality treatment in the management of high-risk prostate cancer. International Journal of Radiation Oncology Biology Physics 2004; 59: 1352 - 1359.
- 209. Stock RG, Cesaretti JA, Stone NN. Disease-specific survival following the brachytherapy management of prostate cancer. *International Journal of Radiation Oncology Biology Physics* 2006; **64**: 810 - 816.
- 210. Stock RG, Kollmeier M, Stone NN. Biochemical outcomes following hormonal therapy, Pd-103 prostate brachytherapy and 3D conformal external beam

irradiation in the treatment of high risk prostate cancer. *International Journal of Radiation Oncology Biology Physics* 2002; **54**: S271.

- Storey MR, Pollack A, Zagars G, *et al.* Complications from radiotherapy dose escalation in prostate cancer: Preliminary results of a randomized trial.
 International Journal of Radiation Oncology Biology Physics 2000; 48: 635 642.
- 212. Suen AW, Ghilezan M, Mohammed N, *et al.* Does brachytherapy reduce morbidity compared to external beam adaptive radiotherapy or pelvic irradiation with brachytherapy boost for localized prostate cancer? *Brachytherapy* 2008; **7**: 118.
- 213. Sunil C, Sarkar PK. Empirical estimation of photoneutron energy distribution in high-energy electron accelerators. *Nuclear Instruments and Methods in Physics Research A* 2007; **581**: 844 849.
- 214. Sylvester JE. High-dose-rate versus low-dose-rate monotherapy in the treatment of localized prostate cancer: The case for high-dose-rate monotherapy: an up and coming treatment option for low-risk prostate cancer *Brachytherapy* 2006; **5**: 1 - 4.
- 215. Takam R, Bezak E, Yeoh EE. Risk of second primary cancer following prostate cancer radiotherapy: DVH analysis using the competitive risk model. *Physics in Medicine and Biology* 2009; 54: 611-625.
- 216. Tanner RJ, Bartlett DT, Hager LG. Operational and dosimetric characteristics of etched-track neutron detectors in routine neutron radiation protection dosimetry. *Radiation Measurements* 2005; **40**: 549 - 559.
- Taussky D, Toi A, McLean M, *et al.* Sequential evaluation of prostate edema following permanent seed prostate brachytherapy using CT-MRI fusion.
 International Journal of Radiation Oncology Biology Physics 2004; **60**: S456.
- 218. Teh BS, Mai W, Huang E, et al. Late gastrointestinal (GI) and genitourinary (GU) toxicity following intensity-modulated radiation therapy (IMRT) for prostate cancer. International Journal of Radiation Oncology Biology Physics 2001; 51: S310 -S311.
- Teslow TN, Ahmad S, Uy NW, *et al.* Comparison of tumor control probability and normal tissue complication probability between 3D-CRT and IMRT plans in patients with prostate cancer. *European Journal of Cancer* 2001; **37**: S204

- S205.

- Thakkar VV, Khuntia D, Reddy C, *et al.* Hypofractionated intensity modulated radiotherapy (70 Gy at 2.5 Gy per fraction) for localized prostate cancer: Long-term outcome results. *International Journal of Radiation Oncology Biology Physics* 2005;
 63: S124 S125.
- Thames HD, Zhang M, Tucker SL, *et al.* Cluster models of dose volume effects.
 International Journal of Radiation Oncology Biology Physics 2004; **59**: 1491 1504.
- Thellenberg C, Malmer B, Tavelin B, *et al.* Second primary cancers in men with prostate cancer: An increased risk of male breast cancer. *The Journal of Urology* 2003; 169: 1345 1348.
- 223. Tran A, Wallner K, Merrick G, *et al.* Rectal fistulas after prostate brachytherapy. *International Journal of Radiation Oncology Biology Physics* 2005; **63**: 150 - 154.
- 224. Travis LB. The epidemiology of second primary cancers. *Cancer Epidemiology, Biomarkers & Prevention* 2006; **15**: 2020 - 2026.
- 225. Tripathy SP, Bakshi AK, Sathian V, et al. Measurement of ²⁴¹Am-Be spectra (bare and Pb-covered) using TLD pairs in multi-spheres: spectrum unfolding by different methods. *Nuclear Instruments and Methods in Physics Research A* 2009; **598**: 556 560.
- 226. van Dyk J. The modern technology of radiation oncology: A compendium for medical physicists and radiation oncologists Wisconsin: Medical Physics Publishing; 1999.
- 227. Vanhavere F, Huyskens D, Struelens L. Peripheral neutron and gamma doses in radiotherapy with an 18 MV linear accelerator. *Radiation Protection Dosimetry* 2004; 110: 607 612.
- 228. Verellen D, Vanhavere F. Risk assessment of radiation-induced malignancies based on whole-body equivalent dose estimates for IMRT treatment in the head and neck region. *Radiotherapy and Oncology* 1999; **53**: 199 - 203.
- 229. Vicini F, Vargas C, Gustafson G, et al. High dose rate brachytherapy in the treatment

of prostate cancer. World Journal of Urology 2003; 21: 220 - 228.

- 230. Virtanen A, Pukkala E, Auvinen A. Incidence of bone and soft tissue sarcoma after radiotherapy: A cohort study of 295,712 Finnish cancer patients. *International Journal of Cancer* 2006; **118**: 1017 - 1021.
- Waller EJ, Jamieson TJ, Cole D, *et al.* Experimental and computational determination of neutron dose equivalent around radiotherapy accelerators. *Radiation Protection Dosimetry* 2003; **107**: 225 232.
- 232. Wallner K, Merrick G, Sutlief S, et al. High-dose regions versus likelihood of cure after prostate brachytherapy. International Journal of Radiation Oncology Biology Physics 2005; 62: 170 - 174.
- Wallner K, Merrick G, True L, et al. ¹²⁵I versus ¹⁰³Pd for low-risk prostate cancer: Preliminary PSA outcomes from a prospective randomized multicenter trial. International Journal of Radiation Oncology Biology Physics 2003; 57: 1297 - 1303.
- Wang B, Xu XG. Measurements of non-target organ doses using MOSFET dosemeters for selected IMRT and 3D-CRT radiation treatment procedures.
 Radiation Protection Dosimetry 2008; **128**: 336 342.
- Warkentin B, Stavrev P, Stavreva N, et al. A TCP-NTCP estimation module using DVHs and known radiobiological models and parameter sets. *Journal of Applied Clinical Medical Physics* 2004; 5: 50 - 63.
- Waterman FM, Dicker AP. Probability of late rectal morbidity in ¹²⁵I prostate brachytherapy. *International Journal of Radiation Oncology Biology Physics* 2003; 55: 342 - 353.
- 237. Withers HR, Taylor JMG, Maciejewski B. Treatment volume and tissue tolerance. *International Journal of Radiation Oncology Biology Physics* 1988; **14**: 751 - 759.
- Wust P, von Borczyskowski DW, Henkel T, *et al.* Clinical and physical determinants for toxicity of 125-I seed prostate brachytherapy. *Radiotherapy and Oncology* 2004; 73: 39 48.
- 239. Xu XG, Bednarz B, Paganetti H. A review of dosimetry studies on external-beam radiation treatment with respect to second cancer induction. *Physics in Medicine*

and Biology 2008; 53: R193 - R241.

- 240. Yeoh EE, Fraser RJ, McGowan RE, *et al.* Evidence for efficacy without increased toxicity of hypofractionated radiotherapy for prostate carcinoma: early results of a phase III randomized trial *International Journal of Radiation Oncology Biology Physics* 2003; **55**: 943 955.
- Yeoh EE, Holloway RH, Fraser RJ, *et al.* Hypofractionated versus conventionally fractionated radiation therapy for prostate carcinoma: updated results of a phase III randomized trial. *International Journal of Radiation Oncology Biology Physics* 2006; 66: 1072 1083.
- 242. Yogeswaren ST, Teh BS, Mai W, et al. Radiation dose to testicles and serum testosterone levels in low risk prostate cancer patients undergoing intensitymodulated radiation therapy (IMRT). International Journal of Radiation Oncology Biology Physics 2004; 60: S456.
- Yorke ED, Kutcher GJ, Jackson A, *et al.* Probability of radiation-induced complications in normal tissues with parallel architecture under conditions of uniform whole or partial organ irradiation. *Radiotherapy and Oncology* 1993; 26: 226 237.
- 244. Yoshioka Y, Nose T, Yoshida K, et al. High-dose-rate brachytherapy as monotherapy for localized prostate cancer: A retrospective analysis with special focus on tolerance and chronic toxicity. International Journal of Radiation Oncology Biology Physics 2003; 56: 213 - 220.
- Yurdakul G, de Reijke TM, Blank LECM, *et al.* Rectal squamous cell carcinoma 11 years after brachytherapy for carcinoma of the prostate. *The Journal of Urology* 2003; 169: 280.
- 246. Zaider M, Zelefsky MJ, Cohen GN, *et al.* Methodology for biologically-based treatment planning for combined low-dose-rate (permanent implant) and highdose-rate (fractionated) treatment of prostate cancer. *International Journal of Radiation Oncology Biology Physics* 2005; **61**: 702 - 713.
- 247. Zanini A, Durisi E, Fasolo F, *et al.* Monte Carlo simulation of the photoneutron field in linac radiotherapy treatments with different collimation systems. *Physics in*

Medicine and Biology 2004; **49**: 571 - 582.

- Zelefsky M, Kuban DA, Levy L, *et al.* Long-term multi-institutional analysis of stage T1-T2 prostate cancer treated with permanent brachytherapy. *International Journal of Radiation Oncology Biology Physics* 2005; 63: S33 - S34.
- Zelefsky MJ, Fuks Z, Happersett L, *et al.* Clinical experience with intensity modulated radiation therapy (IMRT) in prostate cancer. *Radiotherapy and Oncology* 2000; 55: 241 - 249.
- Zelefsky MJ, Lee WR. Chapter 13H: Brachytherapy. In: Vogelzang NJ, Scardino PT,
 Shipley WU, *et al.*, editors. Comprehensive textbook of genitourinary oncology.
 Philadelphia: Lippincott Williams & Wilkins; 2006.
- 251. Zelefsky MJ, Valicenti RK, Goodman K, *et al.* Chapter 58 Prostate Cancer. In: Perez CA, Brady LW, Halperin EC, *et al.*, editors. Principles and practice of radiation oncology. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2004.
- 252. Zeller JL, Lynm C, Glass RM. Grading of prostate cancer. *The Journal of the American Medical Association* 2007; **298**: 1596.
- 253. Zietman AL, DeSilvio ML, Slater JD, *et al.* Comparison of conventional-dose vs highdose conformal radiation therapy in clinically localized adenocarcinoma of the prostate: a randomized controlled trial *The Journal of the American Medical Association* 2005; **294**: 1233 - 1239.