RADIATION PROCTITIS-WHICH TECHNOLOGY IS SAFEST?

Richard G. Stock, MD.
Professor of Radiation Oncology
Mount Sinai School of Medicine
New York, NY

- I have no financial disclosures

Rectal Dose/Volume Effects on Rectal Bleeding

DEFINING THE RISK OF DEVELOPING GRADE 2 PROCTITIS FOLLOWING ^{125}I PROSTATE BRACHYTHERAPY USING A RECTAL DOSE–VOLUME HISTOGRAM ANALYSIS

KURT M. SNYDER, M.D.,* RICHARD G. STOCK, M.D.,* SUZANNE M. HONG, M.A.,* YEH CHI LO, PH.D.,* AND NELSON N. STONE, M.D.†

Table 1. Relationship between volume of rectal wall receiving a given dose and 5-year risk of developing Grade 2 radiation proctitis

Dose (Gy)	Rectal volume cutpoint (cc)	5-Year actuarial Grade 2 proctitis rate (%) ≤Volume cutpoint	5-Year actuarial Grade 2 proctitis rate (%) >Volume cutpoint	*p* value
80	4.0	5	21.0	0.0007
100	3.0	4	20.0	0.0006
120	2.5	5	21.0	0.0002
140	2.0	5	23.6	0.0001
160	1.3	5	18.0	0.0010
180	1.2	5	22.0	0.0002
200	0.8	6	20.0	0.0009
220	0.5	5	18.0	0.0040
240	0.4	5	20.0	0.0009

I. J. Radiation Oncology • Biology • Physics Volume 50, Number 2, 2001

I. J. Radiation Oncology ● Biology ● Physics Volume 50, Number 2, 2001

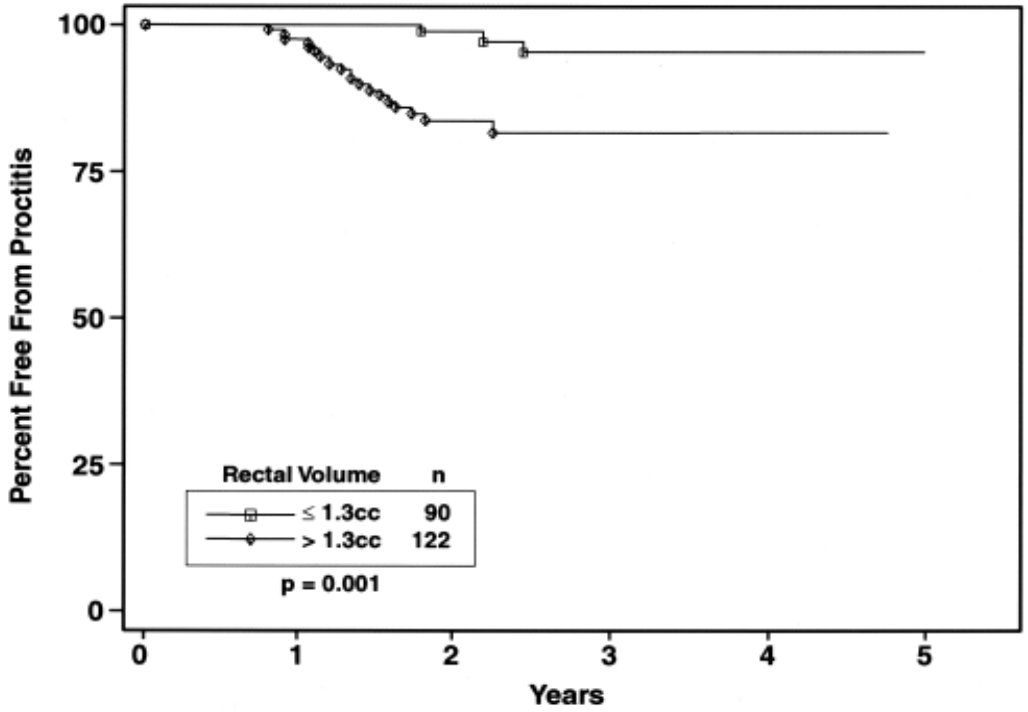


Fig. 2. Effect of rectal volume receiving 160 Gy on Grade 2 proctitis.

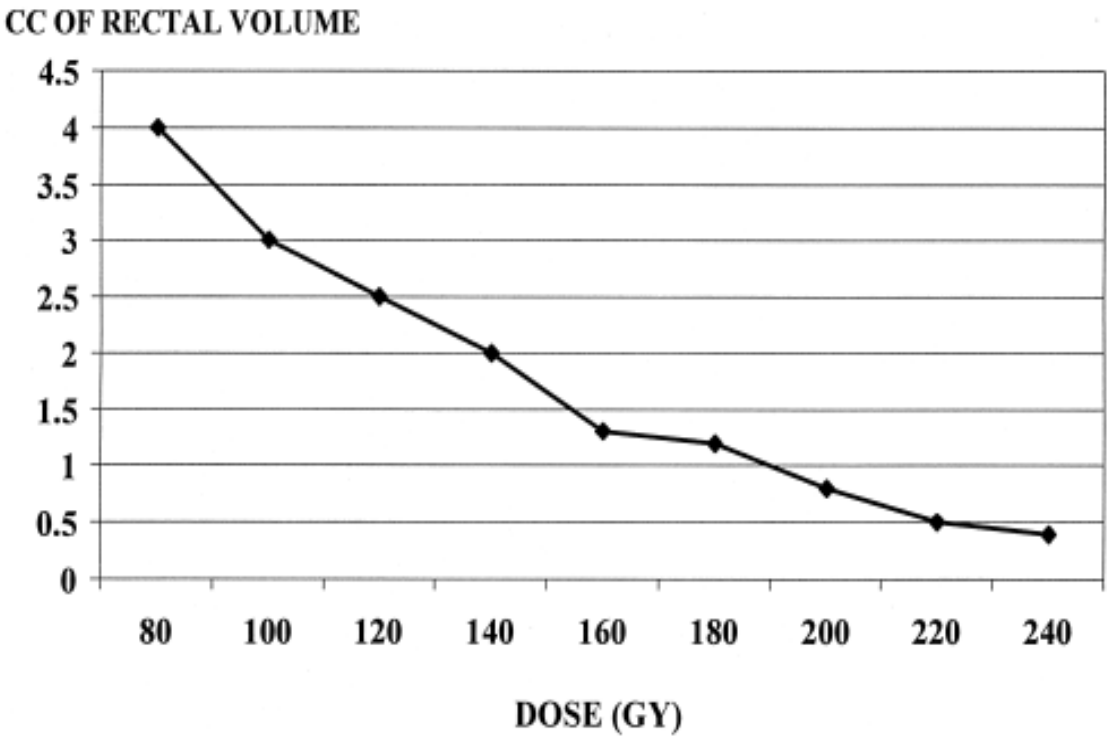
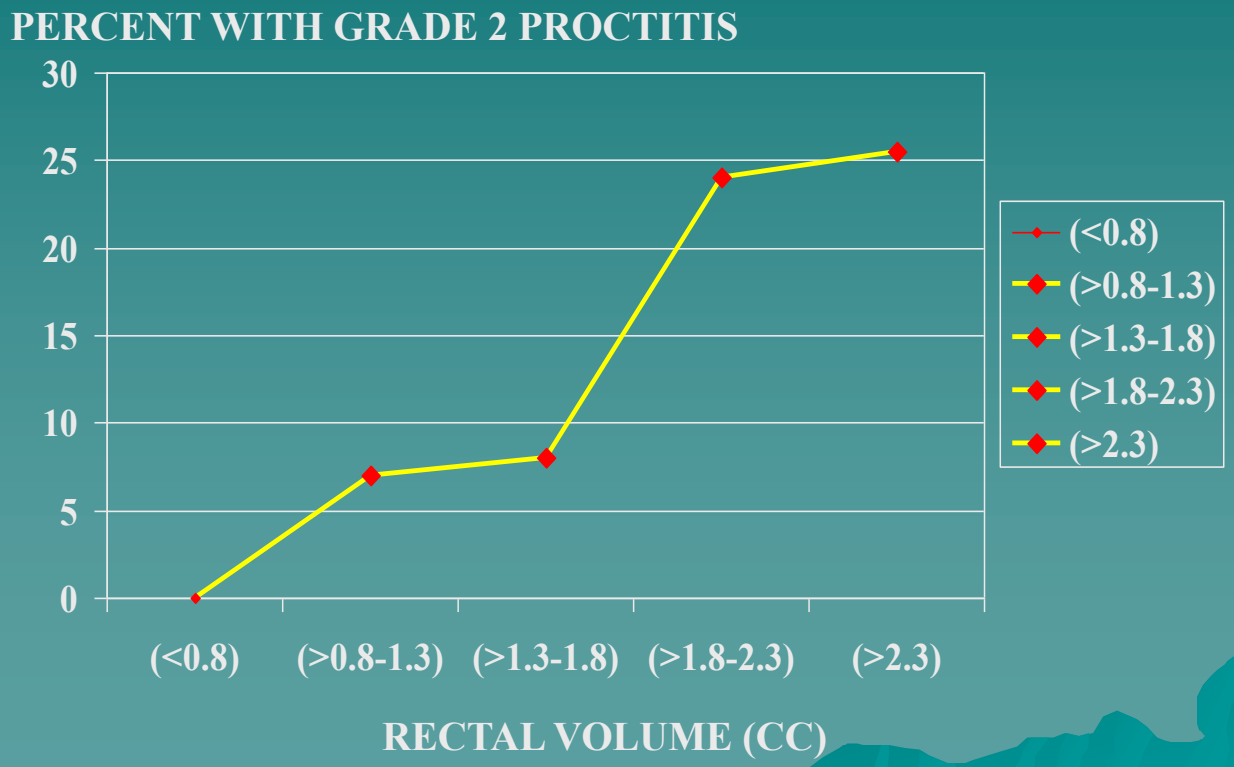
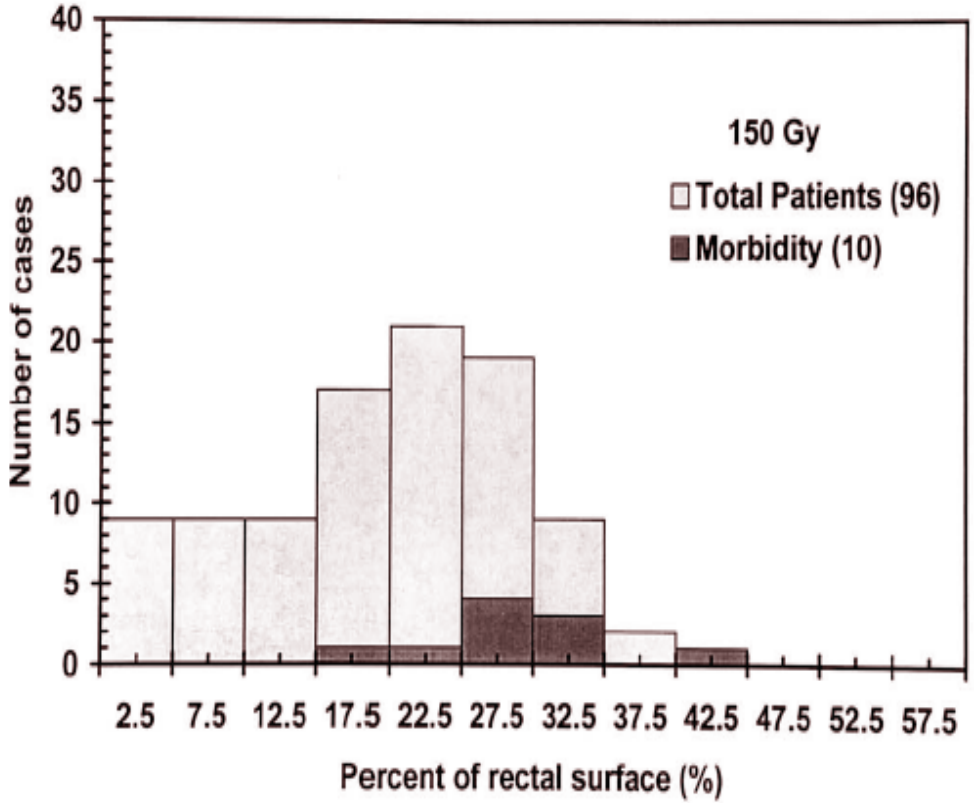


Fig. 4. Rectal volume thresholds associated with ≤5% risk of Grade 2 proctitis at 5 years.

EFFECT OF RECTAL VOLUME RECEIVING 160 GY




150 Gy
Total Patients (96)
Morbidity (10)
Number of cases
0
5
10
15
20
25
30
35
40
2.5
7.5
12.5
17.5
22.5
27.5
32.5
37.5
42.5
47.5
52.5
57.5
Percent of rectal surface (%)

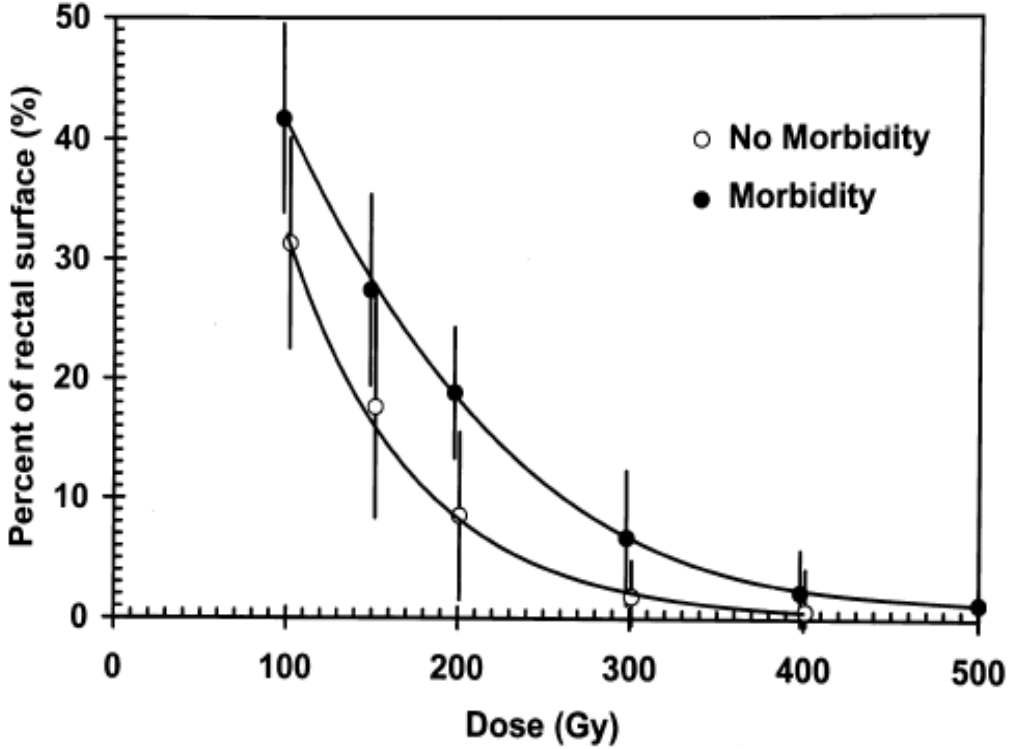


Fig. 2. Mean DSHs of patients who did and did not experience late rectal morbidity. Only the portion of the DSH >100 Gy is shown.

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Dosimetric and Radiographic Correlates to Prostate Brachytherapy-related Rectal Complications

Ben H. Han, M.D.,[1,2] and Kent E. Wallner, M.D.[1,2*]
[1]*Department of Radiation Oncology, University of Washington, Seattle, Washington*
[2]*Radiation Oncology, Puget Sound Health Care System, Department of Veterans Affairs, Seattle, Washington*

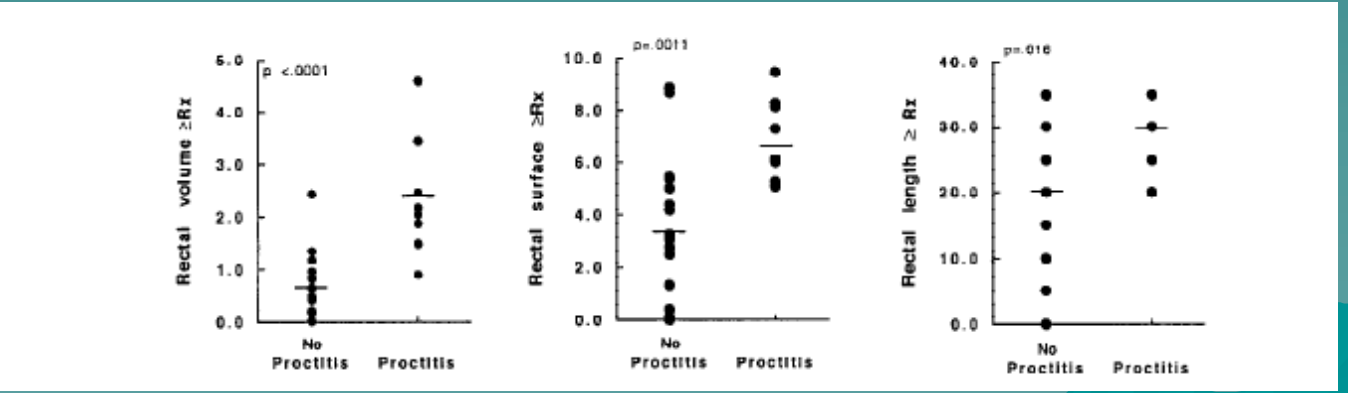

Table 1. Rectal Dosimetric Parameters Exceeding the Prescription Dose in Patients with or without Postimplant Bleeding

	Controls (n = 18)	Proctitis (n = 9)	Significance (two-tailed *t*-test)
Rectal volume ≥ Rx dose[a]	0.6 cc (± 1.3)	2.5 cc (± 0.8)	$P = 0.000008$
Rectal surface ≥ Rx dose	3.1 cm^2 (± 1.4)	6.9 cm^2 (± 1.0)	$P = 0.001$
Rectal length ≥ Rx dose	19 mm (± 3.2)	31 mm (± 3.6)	$P = 0.02$
Maximum rectal dose	224 Gy (± 101)	798 Gy (± 151)	$P = 0.000001$

[a]Rx dose = prescription dose.

ELSEVIER

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UROLOGIC ONCOLOGY

Original article

Defining the rectal dose constraint for permanent radioactive seed implantation of the prostate

Michele Albert, M.D.[a,*], Jun S. Song, Ph.D.[a], Delray Schultz, Ph.D.[c], Robert A. Cormack, Ph.D.[a], Clare M. Tempany, M.D.[b], Steve Haker[b], Phillip M. Devlin, M.D.[a], Clair Beard, M.D.[a], Mark D. Hurwitz, M.D.[a], Wonsuk W. Suh, M.D.[a], Ferenc Jolesz, M.D.[b], Anthony V. D'Amico, M.D., Ph.D.[a]

[a] *Department of Radiation Oncology, Brigham and Women's Hospital and Dana Farber Cancer Institute, Boston, MA 02115, USA*
[b] *Department of Radiology, Brigham and Women's Hospital and Dana Farber Cancer Institute, Boston, MA 02115, USA*
[c] *Department of Mathematics, Millersville University, Millersville, PA 17551, USA*

Received 21 September 2006; received in revised form 11 March 2007; accepted 15 March 2007

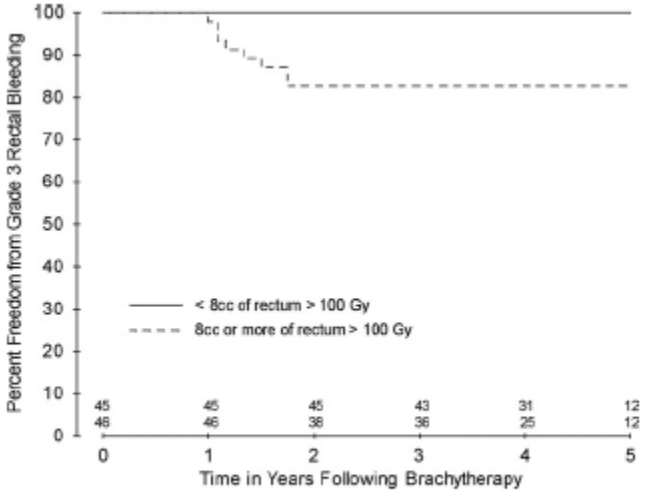


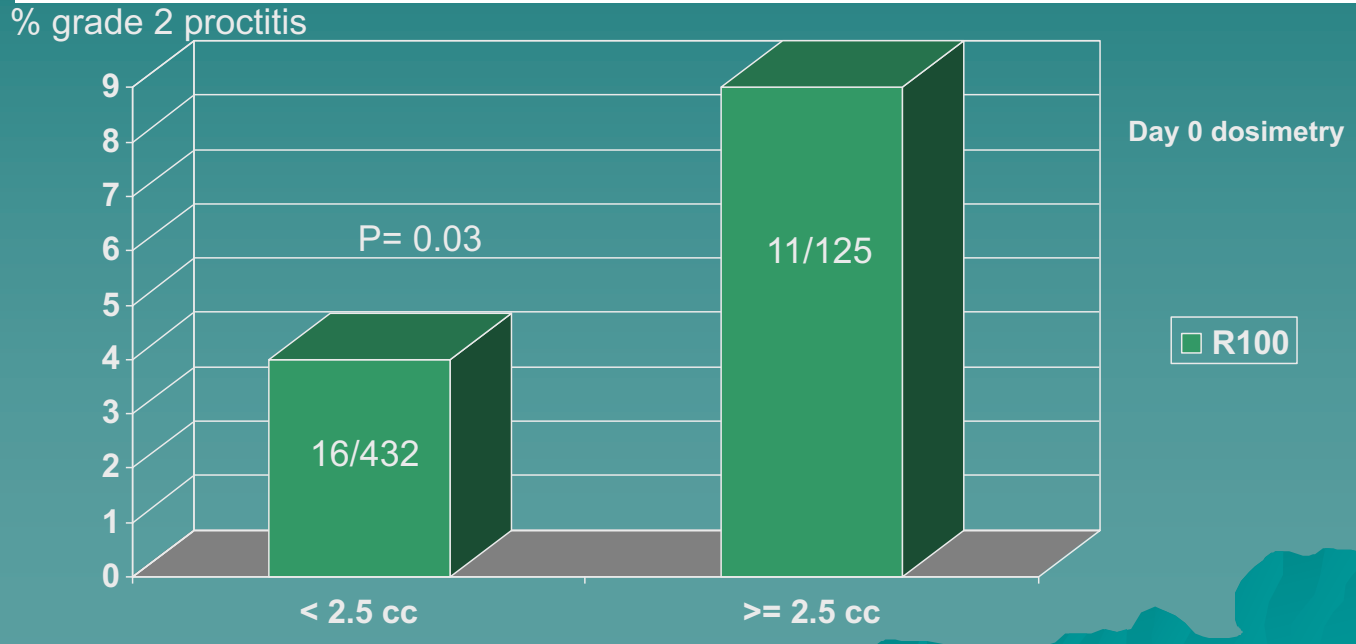
Fig. 1. Estimates of freedom from rectal bleeding requiring argon plasma coagulation stratified by the median volume of rectal contoured exceeding 100 Gy. Log-rank $P = 0.004$.

6 week post implant dosimetry

Intraoperative real-time planned conformal prostate brachytherapy: Post-implantation dosimetric outcome and clinical implications

Michael J. Zelefsky[a,*], Yoshiya Yamada[a], Gil'ad N. Cohen[b], Neha Sharma[a], Alison M. Shippy[a], David Fridman[a], Marco Zaider[b]

[a]Department of Radiation Oncology and [b]Department of Medical Physics, Memorial Sloan-Kettering Cancer Center, NY, USA

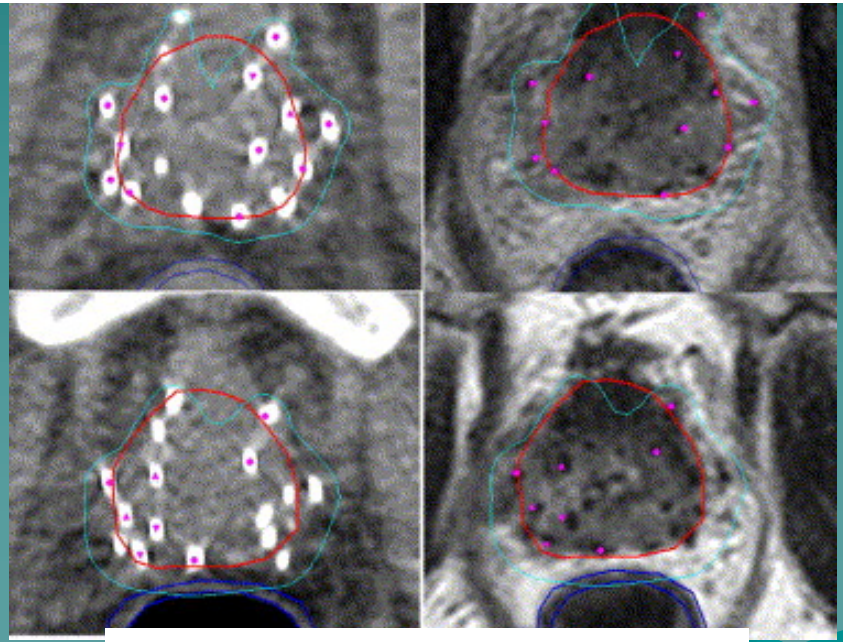


Radiotherapy and Oncology 84 (2007) 185–189.

RECTAL-WALL DOSE DEPENDENCE ON POSTPLAN TIMING AFTER PERMANENT-SEED PROSTATE BRACHYTHERAPY

DANIEL TAUSSKY, M.D.,* IVAN YEUNG, PH.D.,† THERESA WILLIAMS, R.T.T.,‡
SHANNON PEARSON, R.T.T.,‡ MICHAEL MCLEAN, M.D.,* GREGORY POND, M.SC.,§
AND JUANITA CROOK, M.D.*

Departments of *Radiation Oncology, †Radiation Physics, ‡Radiation Medicine, and §Biostatistics, Princess Margaret Hospital, Toronto, Canada



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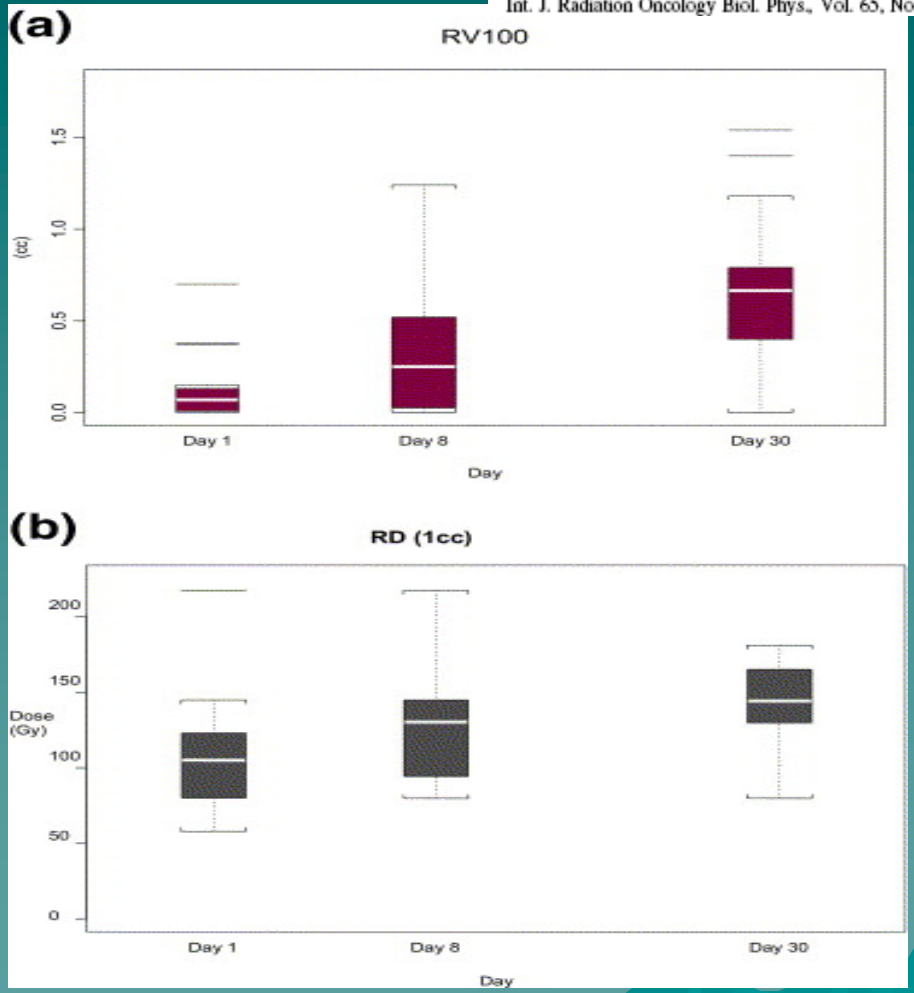
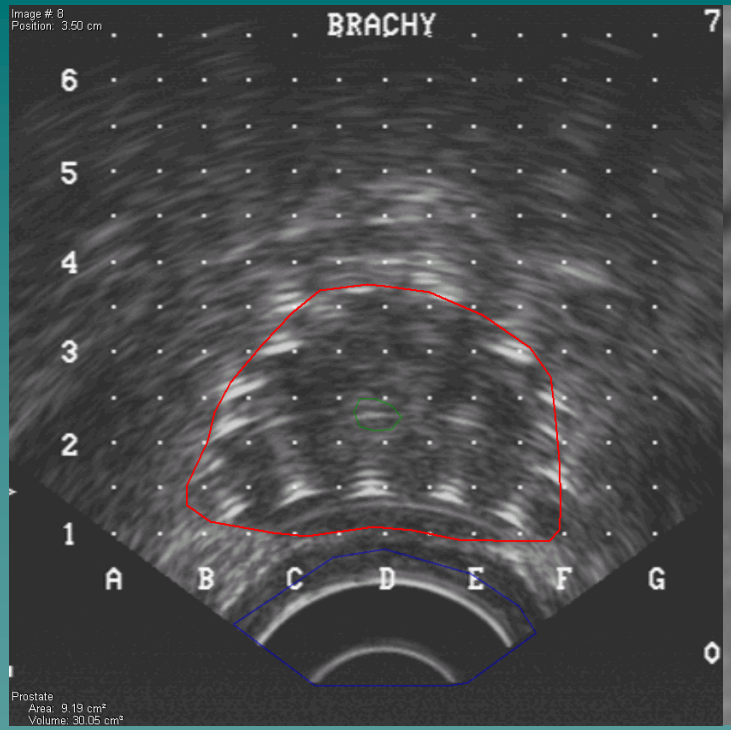


ARE THERE FACTORS THAT WE CAN NOT CONTROL?

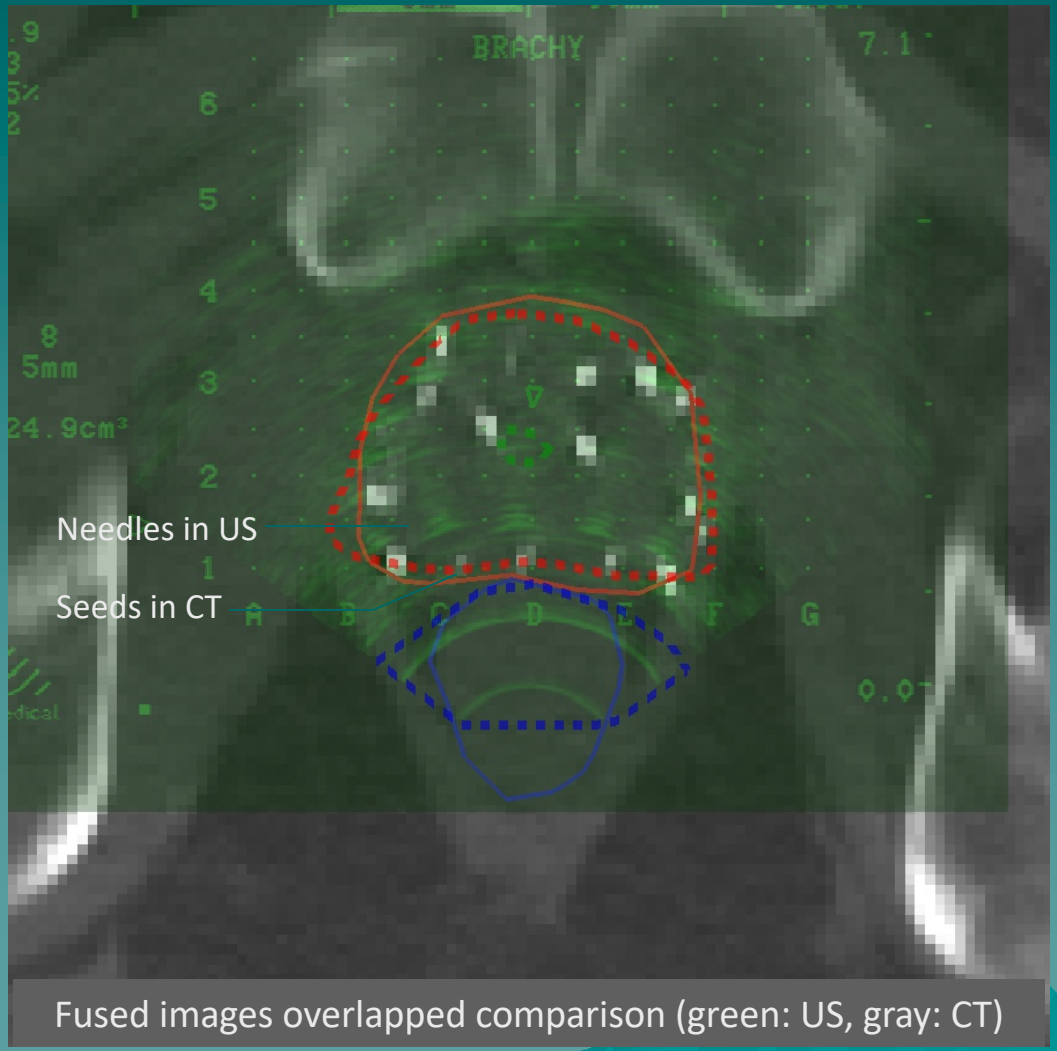
- the exact seed distribution within the prostate

- genetics of radiation response

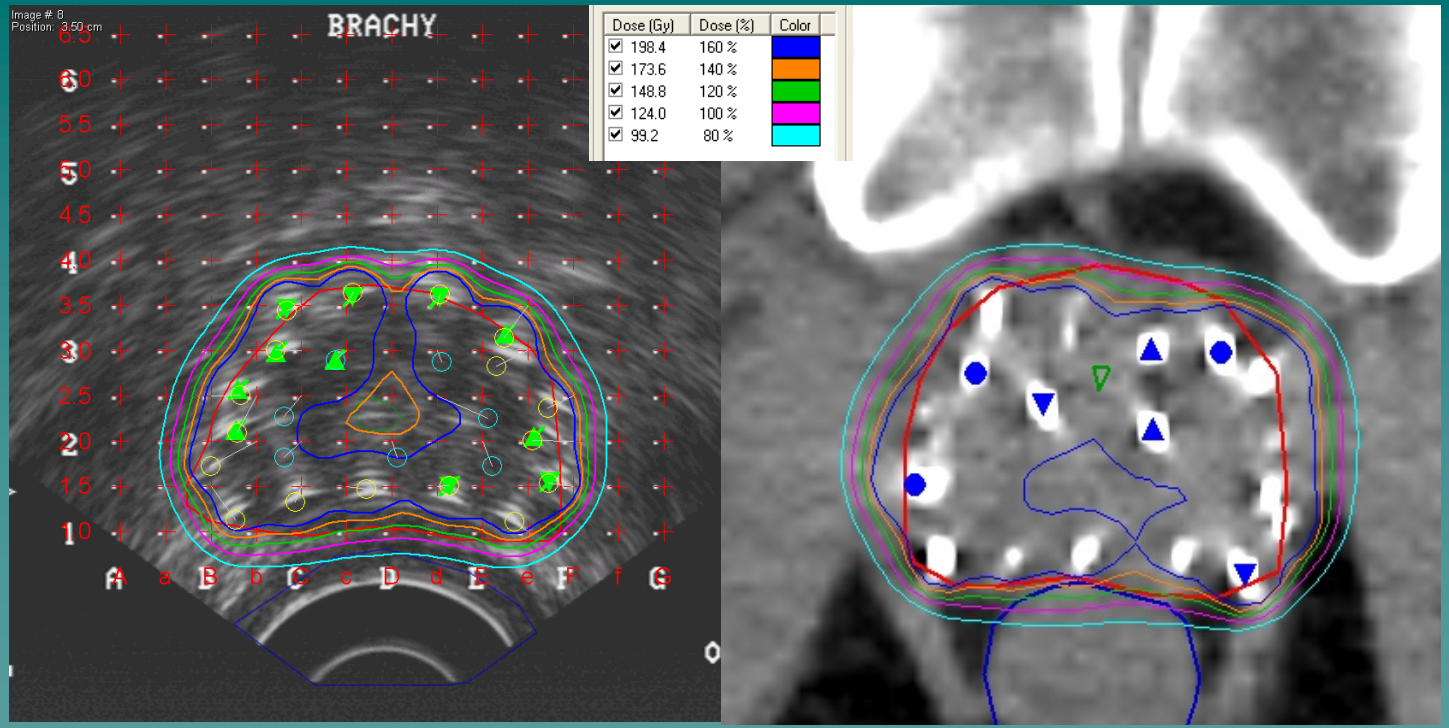


US #8 (real time)

Image #26 (PID)



Fused images overlapped comparison (green: US, gray: CT)



US #8 (real time)

Image #26 (PID)

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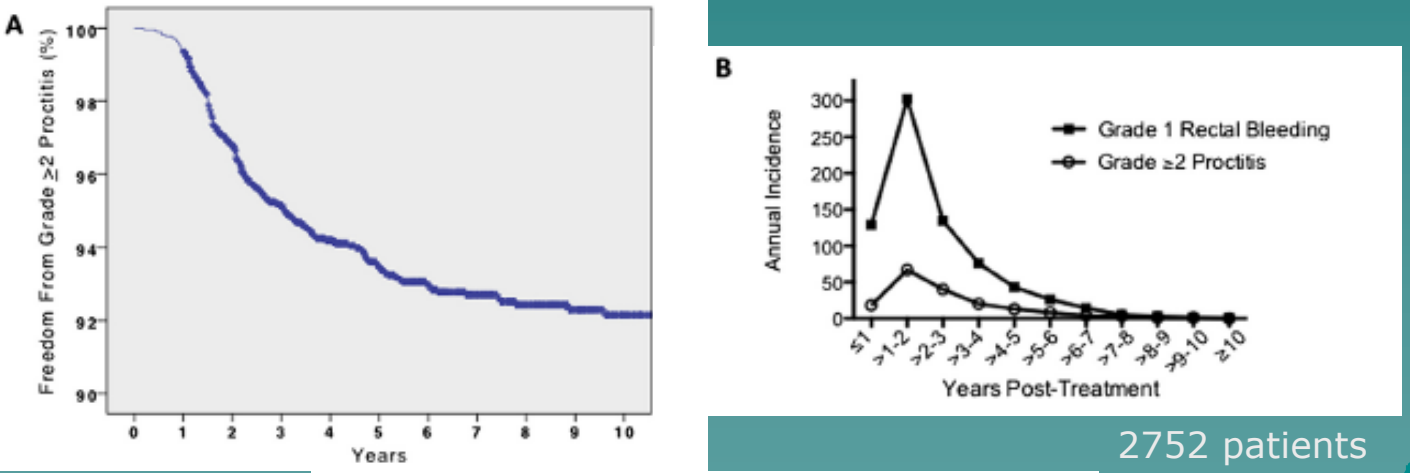
Clinical Investigation: Genitourinary Cancer

Predictive Factors and Management of Rectal Bleeding Side Effects Following Prostate Cancer Brachytherapy

Jeremy G. Price, BA,* Nelson N. Stone, MD,† and Richard G. Stock, MD*

*Departments of *Radiation Oncology and †Urology, Icahn School of Medicine at Mount Sinai, New York, New York*



2752 patients

Fig. 1. (A) Ten-year freedom from grade ≥2 proctitis (%). (B) Annualized incidence of rectal bleeding toxicities following brachytherapy.

Predictive Factors and Management of Rectal Bleeding Side Effects Following Prostate Cancer Brachytherapy

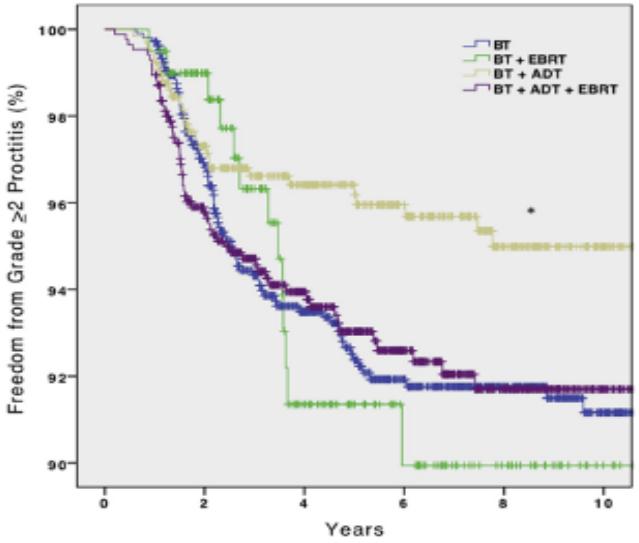


Fig. 2. Effect of treatment modality on the 10-year freedom from grade ≥2 proctitis (%). *$P<.05$. ADT = androgen depletion therapy; BT = brachytherapy; EBRT = external beam radiation therapy.

Table 3 Incidence and rates of rectal morbidities and treatments

Morbidity: n (%)	
Grade 1 bleeding	566 (20.57)
Grade ≥2 proctitis	175 (6.36)
Fistula	3 (0.11)
Ulceration	6 (0.22)
Mean duration (follow-up visits)	1.14
Treatment: n (%)	
Formalin	9 (0.33)
Cauterization	18 (0.65)

A GENETICALLY DETERMINED DOSE–VOLUME HISTOGRAM PREDICTS FOR RECTAL BLEEDING AMONG PATIENTS TREATED WITH PROSTATE BRACHYTHERAPY

JAMIE A. CESARETTI, M.D., M.S.,* RICHARD G. STOCK, M.D.,* DAVID P. ATENCIO, PH.D.,* SHEILA A. PETERS, B.A.,* CHRISTOPHER A. PETERS, M.D.,* RYAN J. BURRI, M.D.,* NELSON N. STONE, M.D.,* AND BARRY S. ROSENSTEIN, PH.D.*†‡§

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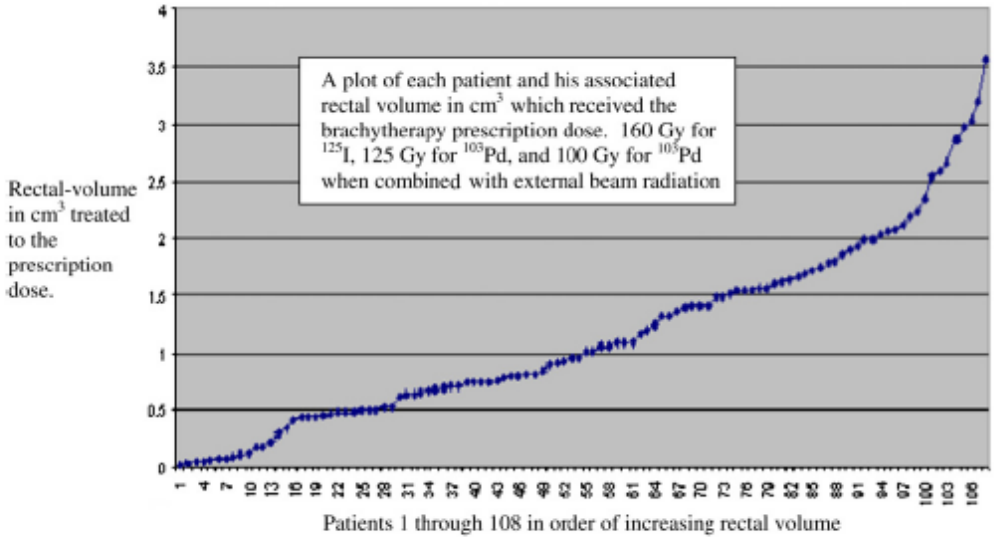
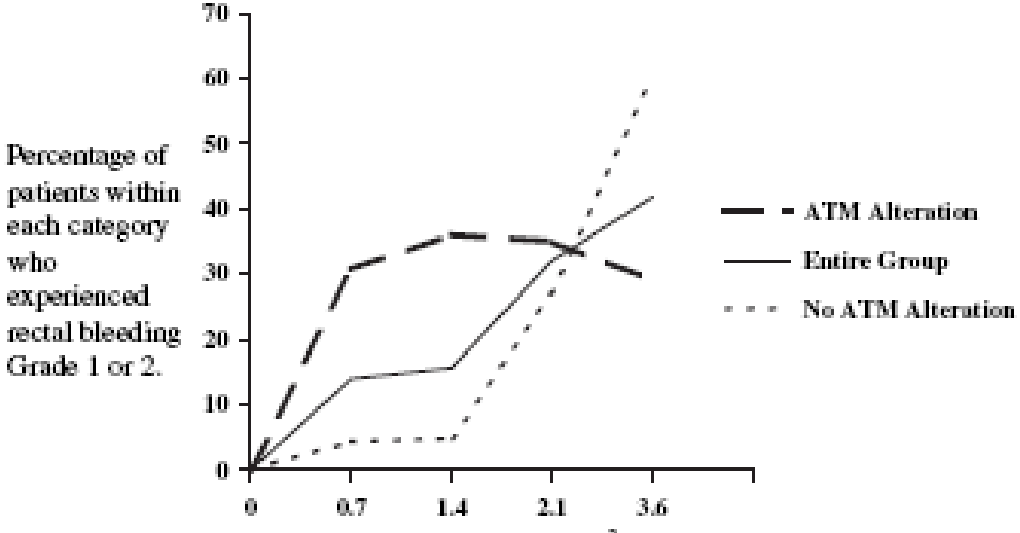


Fig. 1. Rectal dose as represented in volume of rectal tissue treated to the prescription dose using brachytherapy. All 108 patients have a completed characterized *ATM* gene in addition to a detailed clinical history, with a median follow-up of 45 months (range, 12–107 months).



Number of	36	32	28	12
ATM Alteration	4 / 13	4 / 11	6 / 17	2 / 7
No ATM	1 / 23	1 / 21	3 / 11	3 / 5
Fisher's Exact	p=0.05	p=0.04	p=1	p=0.56

Fig. 2. Incidence of Grade 1 or 2 rectal bleeding (%) in the entire group of 108 patients given brachytherapy for prostate cancer and according to their *ATM* gene status.

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GWAS in prostate cancer RT

Genome-wide association study identifies a region on chromosome 11q14.3 associated with late rectal bleeding following radiation therapy for prostate cancer ☆

Sarah L. Kerns [a,b], Richard G. Stock [a], Nelson N. Stone [a,c], Seth R. Blacksburg [a], Lynda Rath [a], Ana Vega [d] Laura Fachal [d], Antonio Gómez-Caamaño [e], Dirk De Ruysscher [f,g], Guido Lammering [g], Matthew Parliament [h], Michael Blackshaw [h], Michael Sia [i], Jamie Cesaretti [j], Mitchell Terk [j], Rosetta Hixson [j], Barry S. Rosenstein [a,k,l,m,*,1], Harry Ostrer [b,n,1]

ABSTRACT

Background and purpose: Rectal bleeding can occur following radiotherapy for prostate cancer and negatively impacts quality of life for cancer survivors. Treatment and clinical factors do not fully predict rectal bleeding, and genetic factors may be important.

Materials and methods: A genome-wide association study (GWAS) was performed to identify SNPs associated with the development of late rectal bleeding following radiotherapy for prostate cancer. Logistic regression was used to test the association between 614,453 SNPs and rectal bleeding in a discovery cohort (79 cases, 289 controls), and top-ranking SNPs were tested in a replication cohort (108 cases, 673 controls) from four independent sites.

Results: rs7120482 and rs17630638, which tag a single locus on chromosome 11q14.3, reached genome-wide significance for association with rectal bleeding (combined p-values 5.4×10^{-8} and 6.9×10^{-7} respectively). Several other SNPs had p-values trending toward genome-wide significance, and a polygenic risk score including these SNPs shows a strong rank-correlation with rectal bleeding (Sommers' $d = 5.0 \times 10^{-12}$ in the replication cohort).

Conclusions: This GWAS identified novel genetic markers of rectal bleeding following prostate radiotherapy. These findings could lead to the development of a predictive assay to identify patients at risk for this adverse treatment outcome so that dose or treatment modality could be modified.

 Radiotherapy and Oncology 107 (2013) 372–376

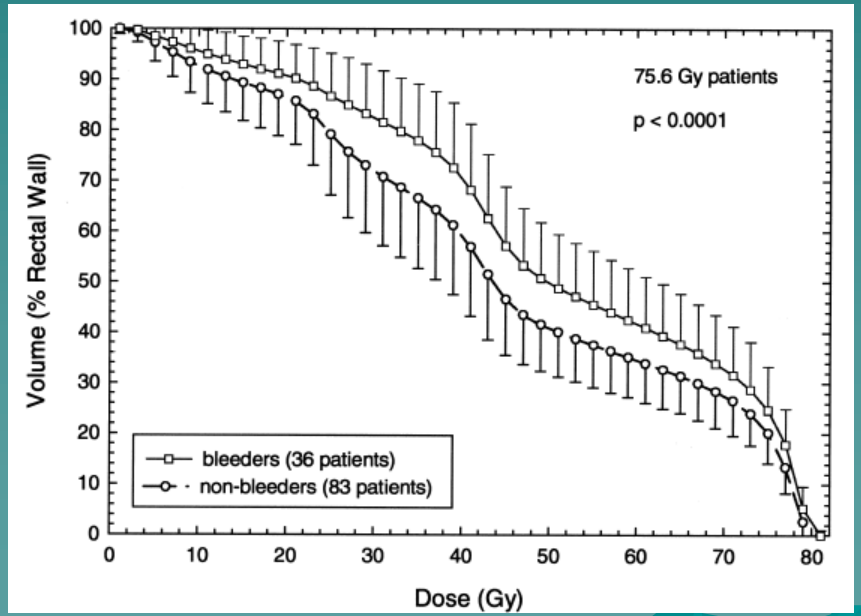
LATE RECTAL BLEEDING AFTER CONFORMAL RADIOTHERAPY OF PROSTATE CANCER (II): VOLUME EFFECTS AND DOSE–VOLUME HISTOGRAMS

ANDREW JACKSON, PH.D.,* MARK W. SKWARCHUK, PH.D.,*[1] MICHAEL J. ZELEFSKY, M.D.,[†] DIDIER M. COWEN, M.D.,[†‡] ENNAPADAM S. VENKATRAMAN, PH.D.,[§] SABINE LEVEGRUN, PH.D.,*[‖] CHANDRA M. BURMAN, PH.D.,* GERALD J. KUTCHER, PH.D.,* ZVI FUKS, M.D.,[†] STEVEN A. LIEBEL, M.D.,[†] AND C. CLIFTON LING, PH.D.*

Departments of *Medical Physics, [†]Radiation Oncology, and [§]Biostatistics, Memorial Sloan-Kettering Cancer Center, New York, NY; [‡]Department of Radiation Oncology, Insitut Paoli-Calmettes Cancer Center, Marseille, France; [‖]Department of Medical Physics, Deutsches Krebsforschungszentrum, Heidelberg, Germany

Int. J. Radiation Oncology Biol. Phys., Vol. 49, No. 3, pp. 685–698, 2001

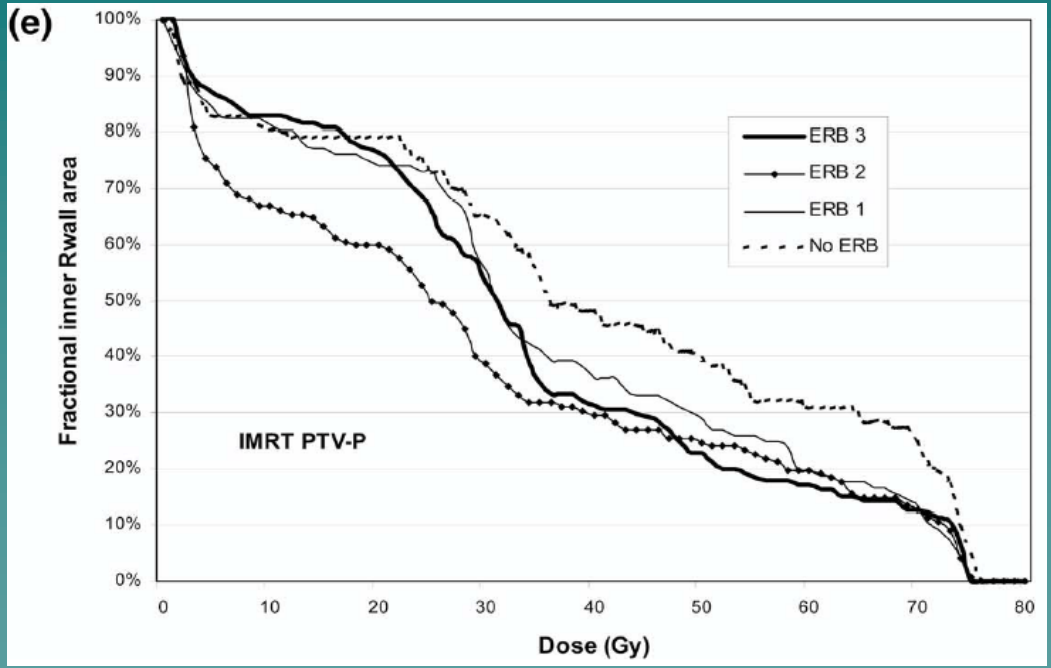
0360-3016/01/$–see front matter



RECTAL WALL SPARING EFFECT OF THREE DIFFERENT ENDORECTAL BALLOONS IN 3D CONFORMAL AND IMRT PROSTATE RADIOTHERAPY

EMILE N. J. TH. VAN LIN, M.D., ASWIN L. HOFFMANN, M.SC., PETER VAN KOLLENBURG, B.SC., JAN WILLEM LEER, M.D., PH.D. AND ANDRIES G. VISSER, PH.D.

Department of Radiation Oncology, Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands

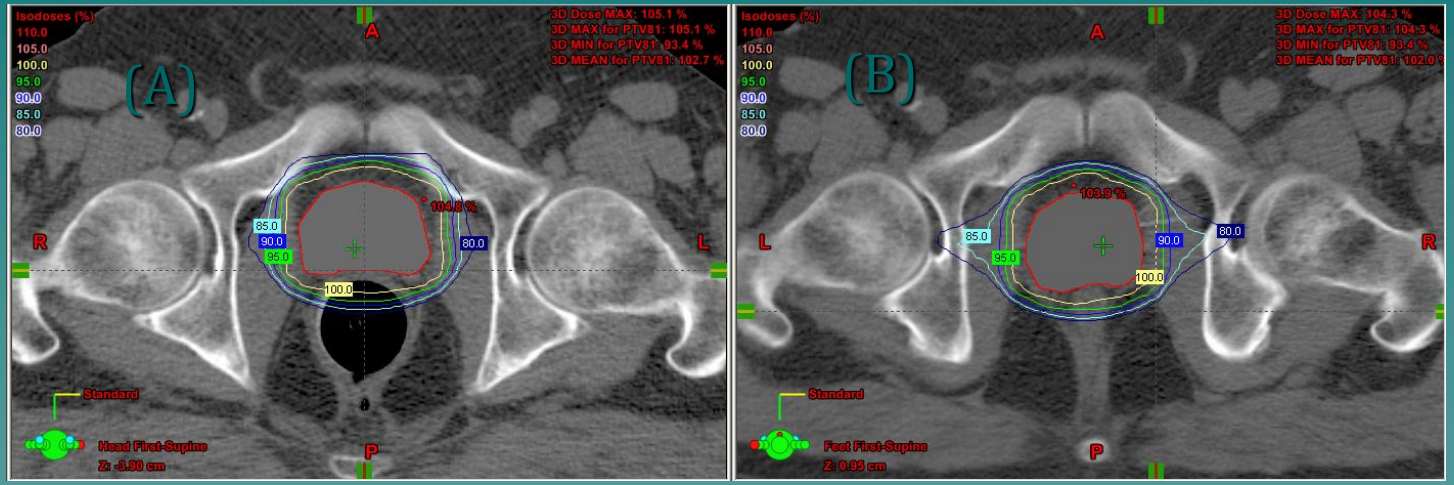


IMRT Plan

Int. J. Radiation Oncology Biol. Phys., Vol. 63, No. 2, pp. 565–576, 2005

0360-3016/05/$–see front matter

Results

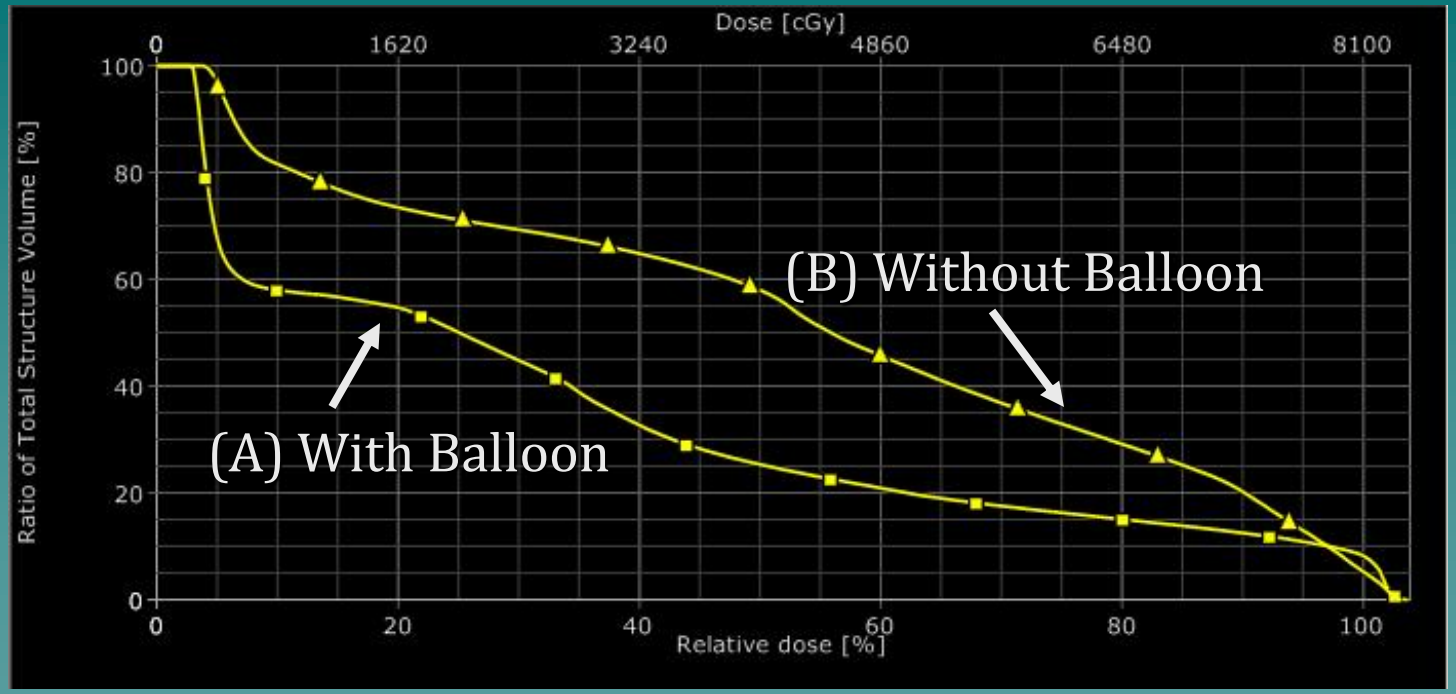


(A) With Balloon

(B) Without Balloon

Sample screen shot showing isodose lines around prostate with (A) and without (B) rectal balloon in place

Results



Sample screen shot showing rectal wall DVH (cumulative) with (A) and without (B) rectal balloon in place.

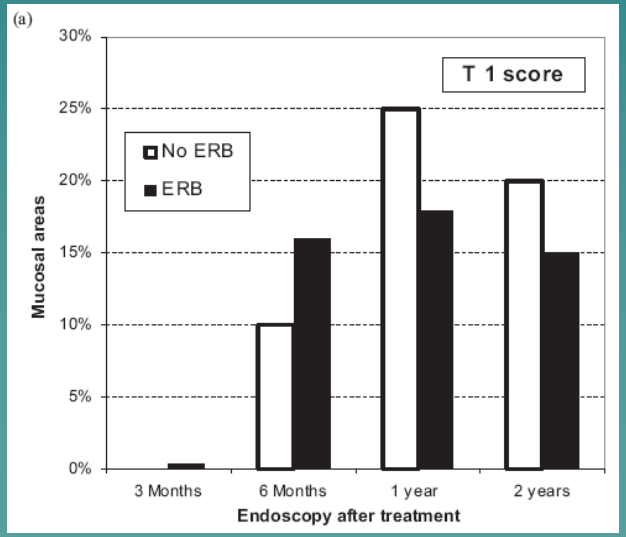
REDUCED LATE RECTAL MUCOSAL CHANGES AFTER PROSTATE THREE-DIMENSIONAL CONFORMAL RADIOTHERAPY WITH ENDORECTAL BALLOON AS OBSERVED IN REPEATED ENDOSCOPY

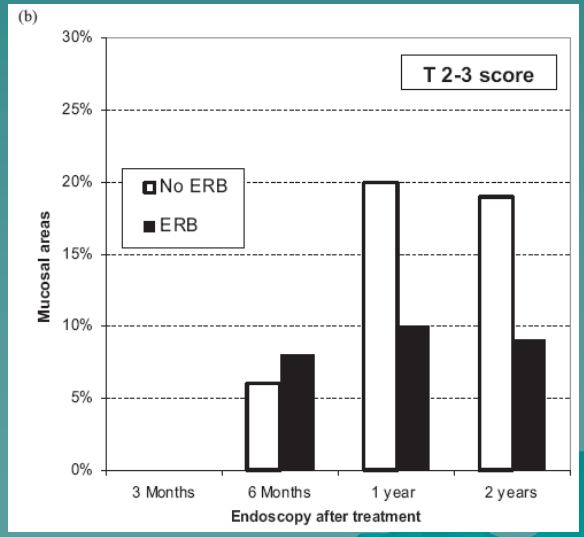
EMILE N. J. TH. VAN LIN, M.D.,* JÓN KRISTINSSON, M.D.,† MARIËLLE E. P. PHILIPPENS, M.D.,* DIRK J. DE JONG, M.D., PH.D.,† LISETTE P. VAN DER VIGHT, B.SC.,* JOHANNES H. A. M. KAANDERS, M.D., PH.D.,* JAN WILLEM LEER, M.D., PH.D.,* AND ANDRIES G. VISSER, PH.D.*

*Department of Radiation Oncology, Radboud University Nijmegen Medical Centre, and †Department of Gastroenterology and Hepatology, Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands

Int. J. Radiation Oncology Biol. Phys., Vol. 67, No. 3, pp. 799–811, 2007

0360-3016/07/$–see front matter





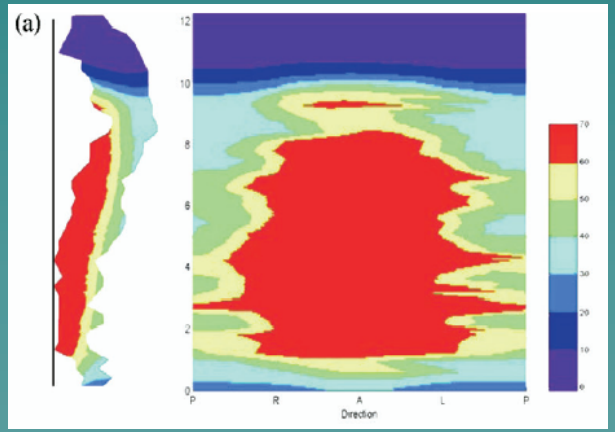
CLINICAL INVESTIGATION Prostate

REDUCED LATE RECTAL MUCOSAL CHANGES AFTER PROSTATE THREE-DIMENSIONAL CONFORMAL RADIOTHERAPY WITH ENDORECTAL BALLOON AS OBSERVED IN REPEATED ENDOSCOPY

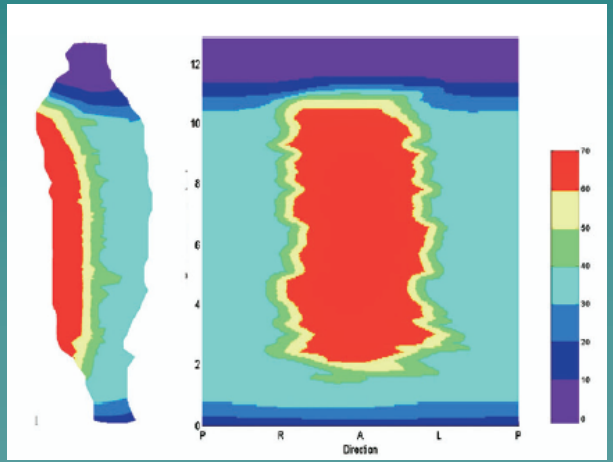
EMILE N. J. TH. VAN LIN, M.D.,* JÓN KRISTINSSON, M.D.,† MARIËLLE E. P. PHILIPPENS, M.D.,*
DIRK J. DE JONG, M.D., PH.D.,† LISETTE P. VAN DER VIGHT, B.SC.,*
JOHANNES H. A. M. KAANDERS, M.D., PH.D.,* JAN WILLEM LEER, M.D., PH.D.,*
AND ANDRIES G. VISSER, PH.D.*

*Department of Radiation Oncology, Radboud University Nijmegen Medical Centre, and †Department of Gastroenterology and Hepatology, Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands

WITHOUT RECTAL BALLOON



WITH RECTAL BALLOON



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0360-3016/07/$–see front matter

PATIENT TOLERANCE OF RECTAL BALLOONS IN CONFORMAL RADIATION TREATMENT OF PROSTATE CANCER

BRIAN B. RONSON, M.D., LES T. YONEMOTO, M.D., CARL J. ROSSI, M.D.,
JAMES M. SLATER, M.D., F.A.C.R., AND JERRY D. SLATER, M.D.

Department of Radiation Medicine, Loma Linda University Medical Center, Loma Linda, CA

3561 men with prostate cancer over 25 years

Table 1. Patient tolerance of rectal balloons

Patient group/s	Patients tolerating balloon throughout treatment	Patients not tolerating balloon throughout treatment	Comment
All patients	3474/3561 (97.6%)	87/3561 (2.4%)	Balloon utilized for 85.5% (mean percent) of treatment days in 87 patients not tolerating balloon throughout treatment
Prostate vs. prostate/pelvic irradiation	1721/1730 (99.5%) vs. 1753/1831 (95.7%)	9/1730 (0.5%) vs. 78/1831 (4.3%)	$p < 0.001$*
2D vs. 3D planning of pelvic X-ray fields	1372/1433 (95.74%) vs. 381/398 (95.72%)	61/1433 (4.26%) vs. 17/398 (4.28%)	$p = 0.990$*

* Chi-square analysis.

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0360-3016/06/$–see front matter

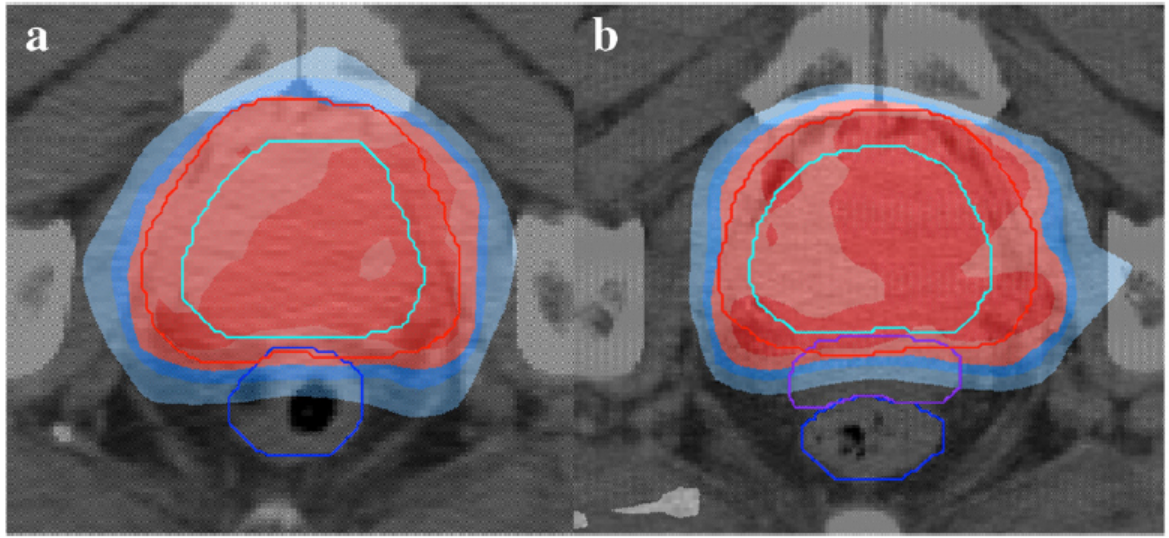
Uhl *et al. Radiation Oncology* 2014, **9**:96
http://www.ro-journal.com/content/9/1/96

RADIATION ONCOLOGY

RESEARCH **Open Access**

Absorbable hydrogel spacer use in men undergoing prostate cancer radiotherapy: 12 month toxicity and proctoscopy results of a prospective multicenter phase II trial

Matthias Uhl[1*], Klaus Herfarth[1], Michael J Eble[2], Michael Pinkawa[2], Baukelien van Triest[3], Robin Kalisvaart[3], Damien C Weber[4], Raymond Miralbell[4], Danny Y Song[5] and Theodore L DeWeese[5]



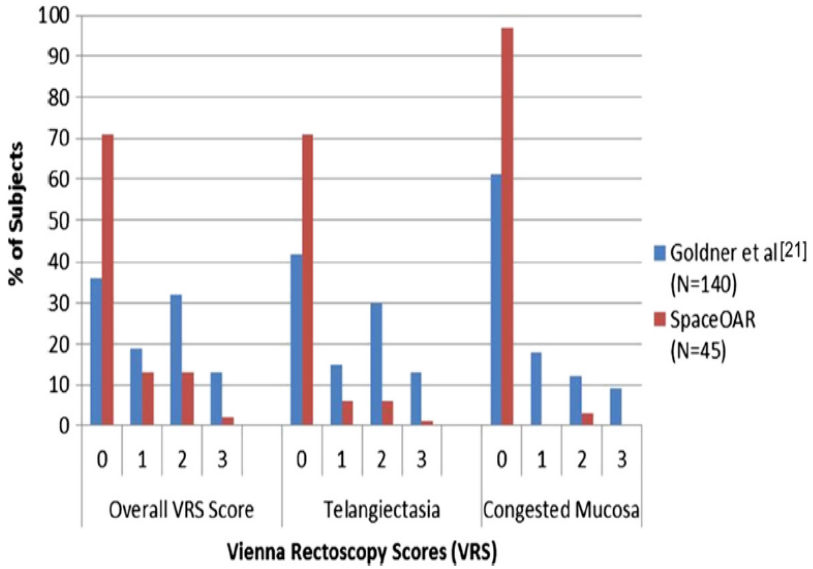


Figure 3 Comparison of Vienna rectoscopy scores at 12 months for men treated with SpaceOAR vs. the literature [21].

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Rectal spacers

Comparison of two different rectal spacers in prostate cancer external beam radiotherapy in terms of rectal sparing and volume consistency

Frank Wolf[a,1,*], Christoph Gaisberger[a,1], Ingrid Ziegler[a], Elisabeth Krenn[f], Philipp Scherer[a], Stephan Hruby[b], Tobias Schätz[b], Rosemarie Forstner[c], Josef Holzinger[e], Andrea Vaszi[a], Gerhard Kametriser[a], Philipp Steininger[d], Heinz Deutschmann[a,d], Felix Sedlmayer[a,d]

[a] Dpt. of Radiation Oncology; [b] Dpt. of Urology; [c] Dpt. of Radiology; [d] Institute for Research and Development on Advanced Radiation Technologies (radART); [e] Dept. of Surgery; and [f] Salzburg University of Applied Sciences, Paracelsus Medical University of Salzburg, Austria

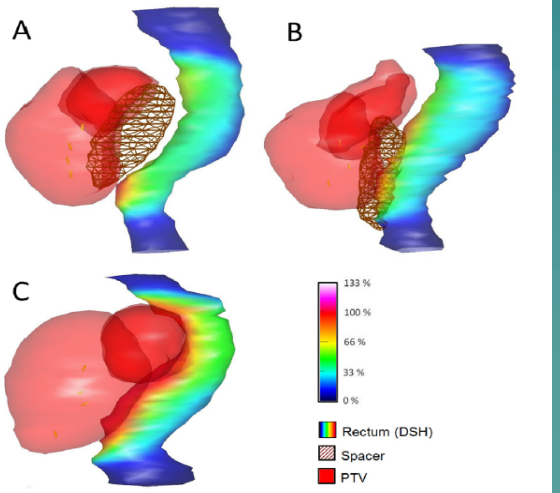

Fig. 3. Visual 3D color wash illustration of balloon (A) gel (B), and control (C) patients.

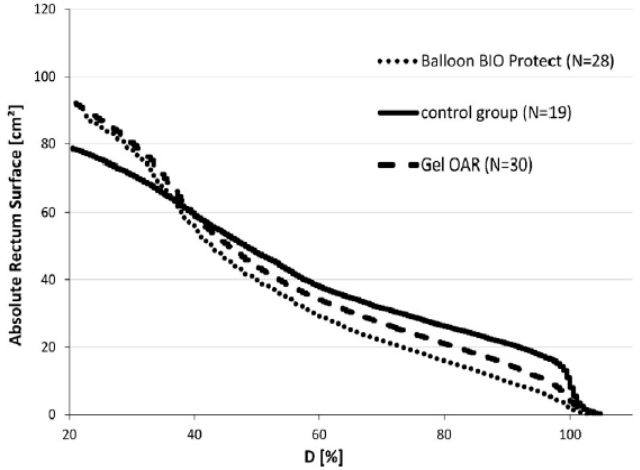

Fig. 2. Absolute dose surface histogram of the rectum of balloon, gel and control patients.

TRANSPERINEAL INJECTION OF HYALURONIC ACID IN ANTERIOR PERIRECTAL FAT TO DECREASE RECTAL TOXICITY FROM RADIATION DELIVERED WITH INTENSITY MODULATED BRACHYTHERAPY OR EBRT FOR PROSTATE CANCER PATIENTS

PEDRO J. PRADA, M.D.,* JOSÉ FERNÁNDEZ, M.D., PH.D.,* ALVARO A. MARTINEZ, M.D.,† ÁNGELES DE LA RÚA, M.D.,* JOSE M. GONZALEZ, M.D.,* JOSE M. FERNANDEZ, M.D.,‡ AND GERMAN JUAN, M.D.*

Departments of *Radiation Oncology and ‡Radiology, Hospital Central de Asturias, Oviedo, Spain; †Department of Radiation Oncology, William Beaumont Hospital, Royal Oak, MI.

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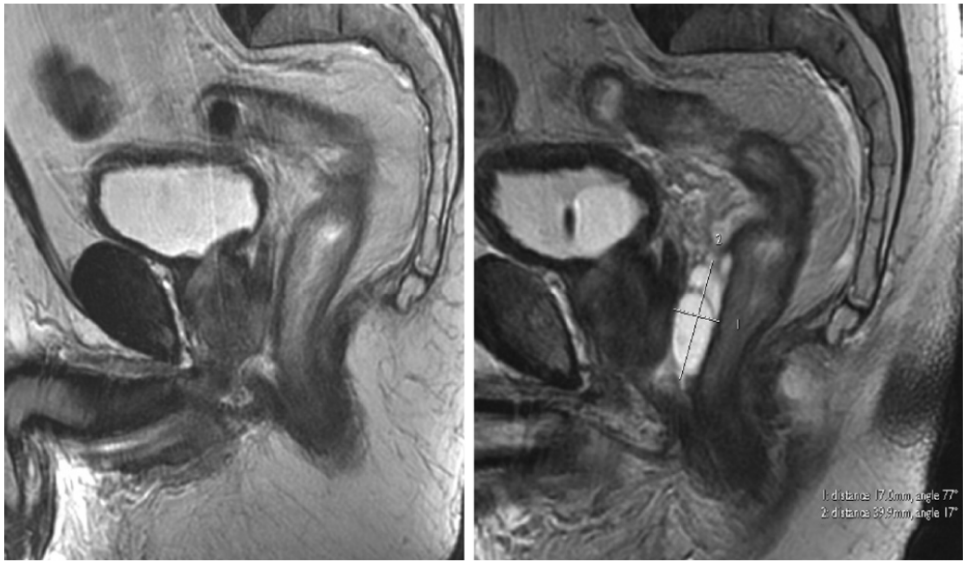

Fig. 4. Magnetic resonance image demonstrating the additional perirectal space created by the hyaluronic acid injection.

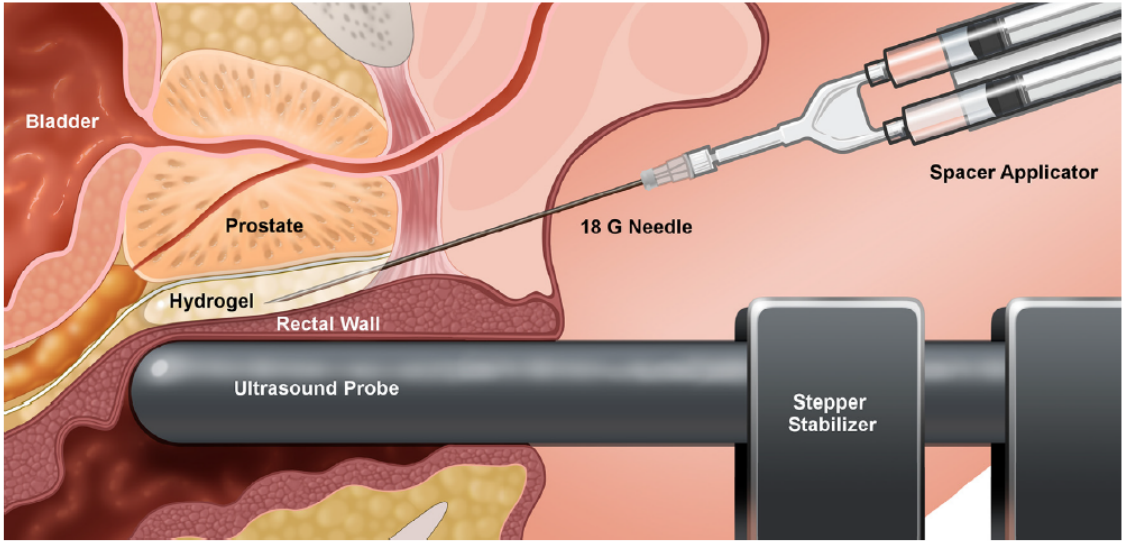

Figure 2. Illustration of transperineal polyethylene glycol hydrogel spacer injection. The needle is placed at the mid-prostate level between Denonvilliers fascia and rectal wall, hydrodissection is performed to confirm proper positioning, and the hydrogel is injected.

A Multi-institutional Clinical Trial of Rectal Dose Reduction via Injected Polyethylene-Glycol Hydrogel During Intensity Modulated Radiation Therapy for Prostate Cancer: Analysis of Dosimetric Outcomes

Danny Y. Song, MD,* Klaus K. Herfarth, MD,† Matthias Uhl, MD,† Michael J. Eble, MD,‡ Michael Pinkawa, MD,‡ Baukelien van Triest, MD, PhD,§ Robin Kalisvaart, MSc,§ Damien C. Weber, MD,‖ Raymond Miralbell, MD,‖ Theodore L. DeWeese, MD,* and Eric C. Ford, PhD¶

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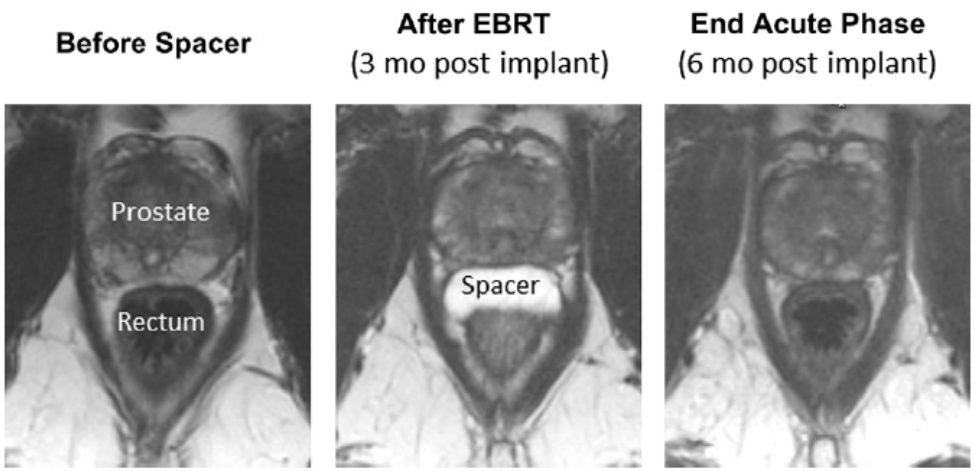

Fig. 1. Axial T2 magnetic resonance images of a patient before hydrogel injection (left), after radiation therapy (middle), and 6 months after injection (right).

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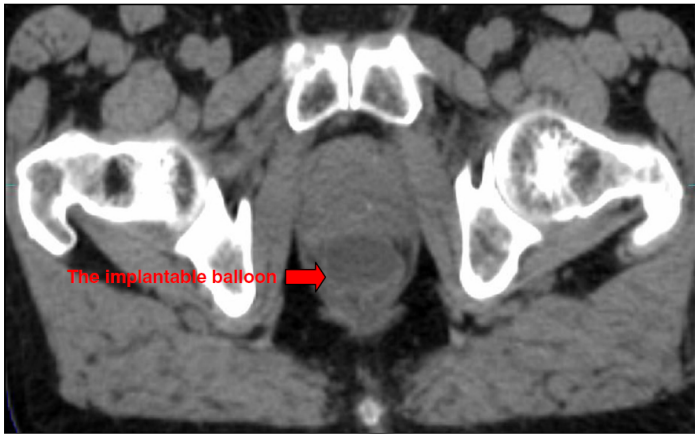
http://www.ro-journal.com/content/8/1/96

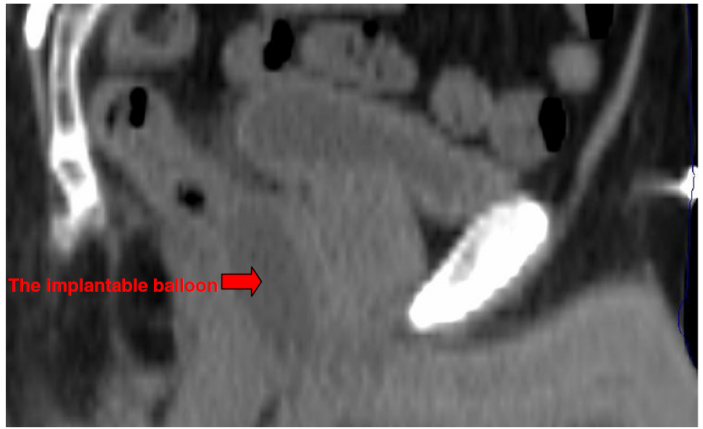
RADIATION ONCOLOGY

RESEARCH Open Access

Application of an interstitial and biodegradable balloon system for prostate-rectum separation during prostate cancer radiotherapy: a prospective multi-center study

Eliahu Gez*†, Shmuel Cytron, Rahamin Ben Yosef, Daniel London, Benjamin W Corn, Shlomi Alani, Giovanni Scarzello, Fabrizio Dal Moro, Guido Sotti, Filiberto Zattoni, Ike Koziol, Taryn Torre, Matthew Bassignani, Shalom Kalnicki, Reza Ghavamian, Dukagjin Blakaj, Mitchell Anscher, Martin Sommerauer, Dieter Jocham, Corinna Melchert, Stefan Huttenlocher, Gyoergy Kovacs† and Madhur Garg





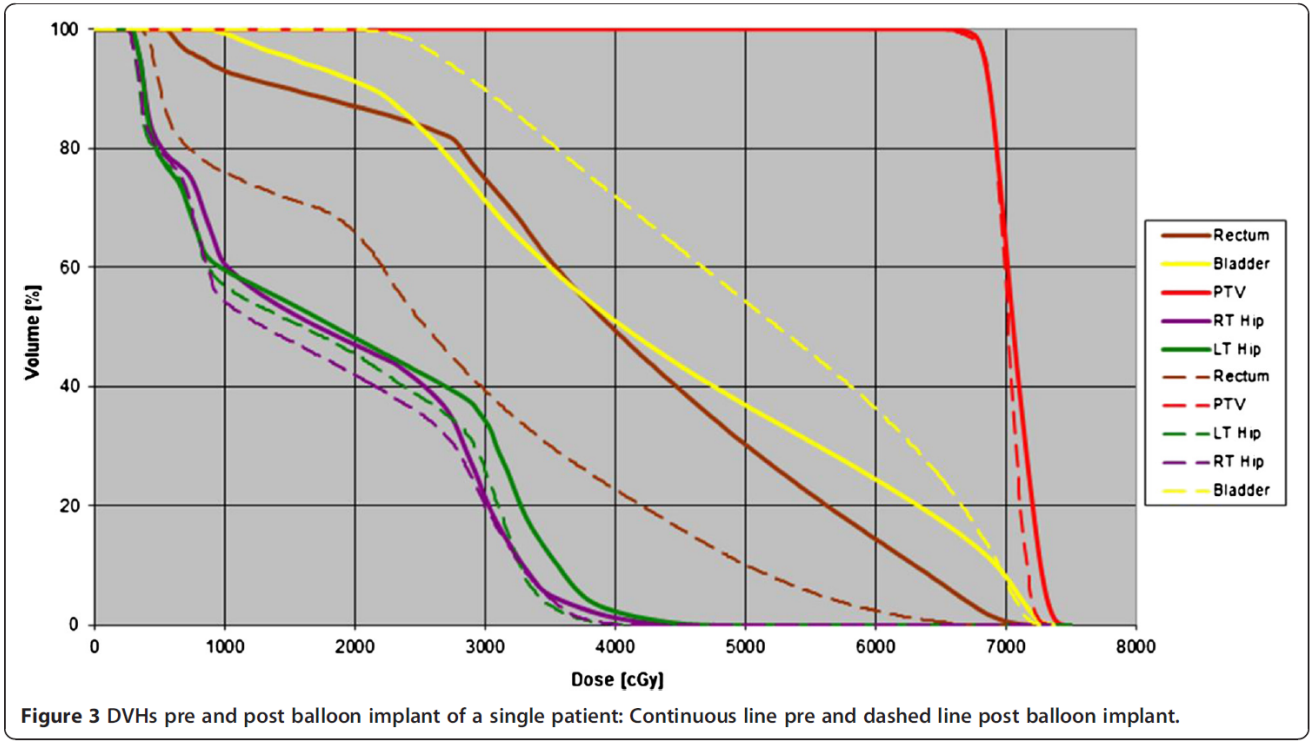


Figure 3 DVHs pre and post balloon implant of a single patient: Continuous line pre and dashed line post balloon implant.

Clinical Investigation

Hydrogel Spacer Prospective Multicenter Randomized Controlled Pivotal Trial: Dosimetric and Clinical Effects of Perirectal Spacer Application in Men Undergoing Prostate Image Guided Intensity Modulated Radiation Therapy

Neil Mariados, MD,* John Sylvester, MD,† Dhiren Shah, MD,‡ Lawrence Karsh, MD,§ Richard Hudes, MD,‖ David Beyer, MD,¶ Steven Kurtzman, MD,# Jeffrey Bogart, MD,** R. Alex Hsi, MD,†† Michael Kos, MD,‡‡ Rodney Ellis, MD,§§ Mark Logsdon, MD,‖‖ Shawn Zimberg, MD,¶¶ Kevin Forsythe, MD,## Hong Zhang, MD, PhD,*** Edward Soffen, MD,††† Patrick Francke, MD,‡‡‡ Constantine Mantz, MD,§§§ Peter Rossi, MD,‖‖‖ Theodore DeWeese, MD,¶¶¶ Daniel A. Hamstra, MD, PhD,### Walter Bosch, DSc,**** Hiram Gay, MD,**** and Jeff Michalski, MD, MBA****

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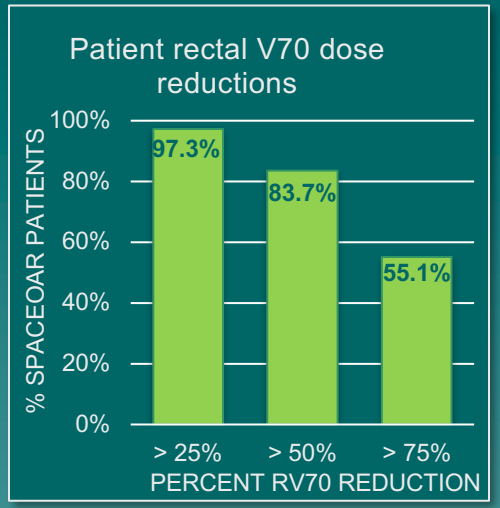

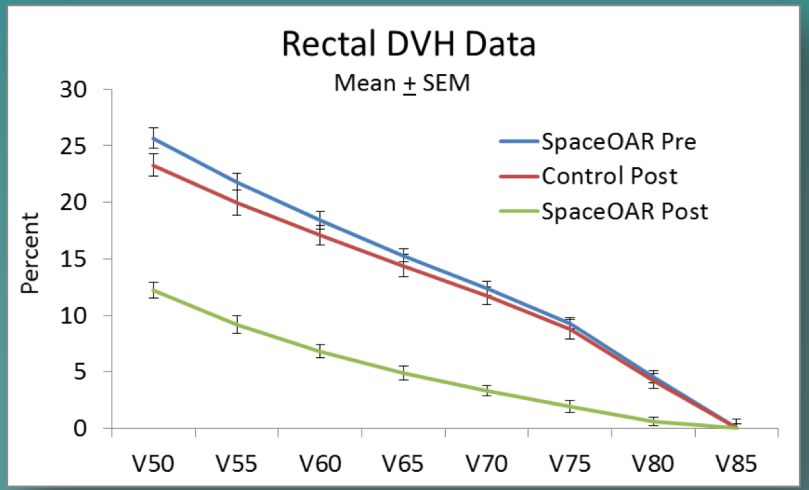

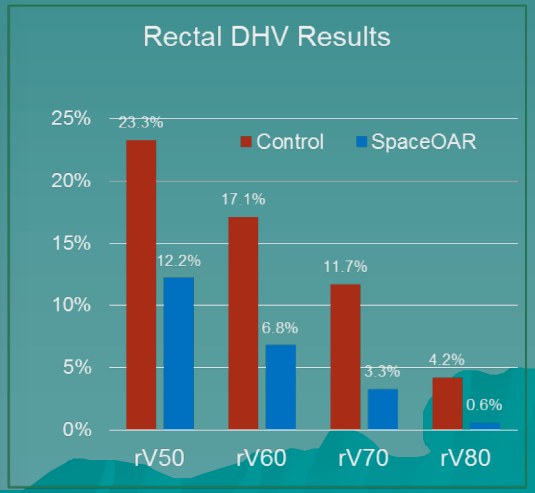

Absorbable Hydrogel Spacer Use in Prostate Radiotherapy: A Comprehensive Review of Phase 3 Clinical Trial Published Data

Lawrence I. Karsh, Eric T. Gross, Christopher M. Pieczonka, Philip J. Aliotta, Christopher J. Skomra, Lee E. Ponsky, Peter T. Nieh, Misop Han, Daniel A. Hamstra, and Neal D. Shore

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Table 1. Statistically significant clinical differences resulting from polyethylene glycol (PEG) hydrogel spacer use during prostate radiotherapy: percent difference relative to nonspacer patients and number needed to treat (NNT) with PEG hydrogel spacer to prevent 1 event

Clinical Outcome	Spacer Arm (%)	Control Arm (%)	*P*-Value	Difference Relative to Control (%)	NNT
Rectal pain adverse events (0-3 mo)	2.7	11.1	.022	76	11.9
Late G1+ rectal toxicity (3-37 mo)	2.0	9.2	.028	78	13.9
Late G2+ rectal toxicity (3-37 mo)	0.0	5.7	.015	100	17.5
Late G1+ urinary incontinence (3-37 mo)	4	15	.046	73	9.1
Percentage of patients experiencing MID declines in bowel QOL (at 37 mo)	14	41	.002	66	3.7
Percentage of patients experiencing MID declines in urinary QOL (at 37 mo)	17	30	<.05	43	7.7
Potent men at baseline retaining erections sufficient for intercourse (at 37 mo)	66.7	37.5	.046	78	3.4
Men experiencing MID declines in all 3 QOL domains (bowel, urinary, and sexual) (at 37 mo)	2.5	20.0	.002	88	5.7

MID, minimally important difference; QOL, quality of life.