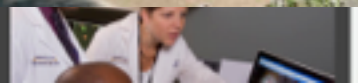
BRAQUITERAPIA EN CÁNCER DE PRÓSTATA

GUSTAVO SARRIA BARDALES, MD
Director Medico Departamento Radioterapia INEN - AUNA

Oncosalud
auna



BRAQUITERAPIA EN CÁNCER DE PRÓSTATA

GUSTAVO SARRIA BARDALES, MD

Director Medico Departamento Radioterapia INEN - AUNA

Incidence / death

Incidence

Males

Prostate	180,890	21%
Lung & bronchus	117,920	14%
Colon & rectum	70,820	8%
Urinary bladder	58,950	7%
Melanoma of the skin	46,870	6%
Non-Hodgkin lymphoma	40,170	5%
Kidney & renal pelvis	39,650	5%
Oral cavity & pharynx	34,780	4%
Leukemia	34,090	4%
Liver & intrahepatic bile duct	28,410	3%
All Sites	**841,390**	**100%**

death

Lung & bronchus	85,920	27%
Prostate	26,120	8%
Colon & rectum	26,020	8%
Pancreas	21,450	7%
Liver & intrahepatic bile duct	18,280	6%
Leukemia	14,130	4%
Esophagus	12,720	4%
Urinary bladder	11,820	4%
Non-Hodgkin lymphoma	11,520	4%
Brain & other nervous system	9,440	3%
All Sites	**314,290**	**100%**

US 2016. *Siegel CA cancer J Clin 2016*

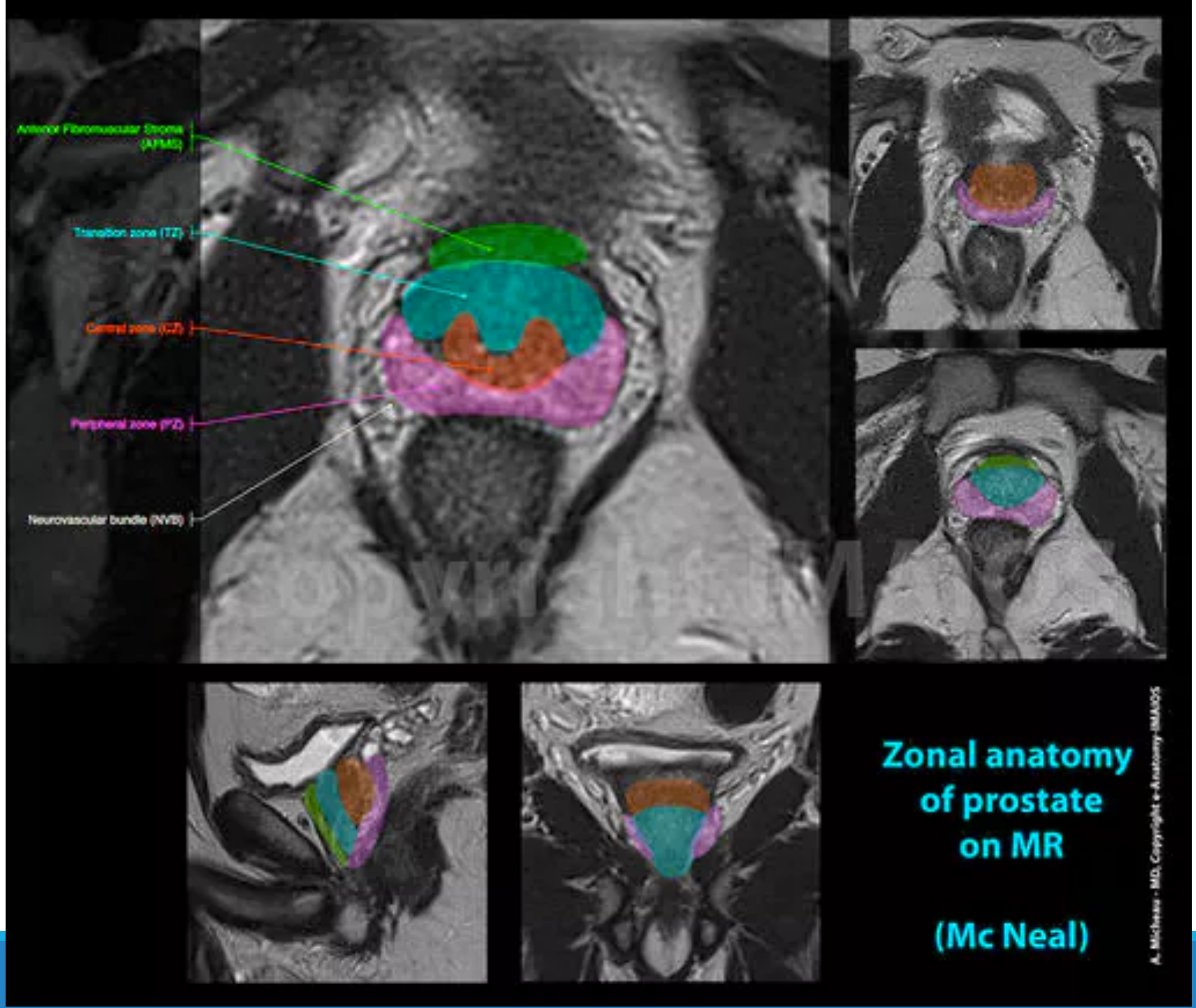

Anterior Fibromuscular Stroma (AFMS)
Transition zone (TZ)
Central zone (CZ)
Peripheral zone (PZ)
Neurovascular bundle (NVB)
Zonal anatomy of prostate on MR
(Mc Neal)

Table 14.1 Risk group definition according to D'Amico and NCCN

Risk group	Low	Intermediate	High
NCCN			
T-stage	cT1c+cT2a and	cT2b – 2c and/or	cT3 or
PSA	<10 ng/ml and	>10–20 ng/ml and/or	>20 ng/ml or
Gleason sum	<7	=7	8–10
D'Amico et al. (1997a, 1998, 1999)			
T-stage	cT1c – 2a and	cT2b and/or	cT2c – cT3 or
PSA	<10 ng/ml and	>10–20 ng/ml and/or	>20 ng/ml or
Gleason sum	<7	=7	8–10

Note that the two classifications differ only by clinical stage in intermediate- and high-risk tumors

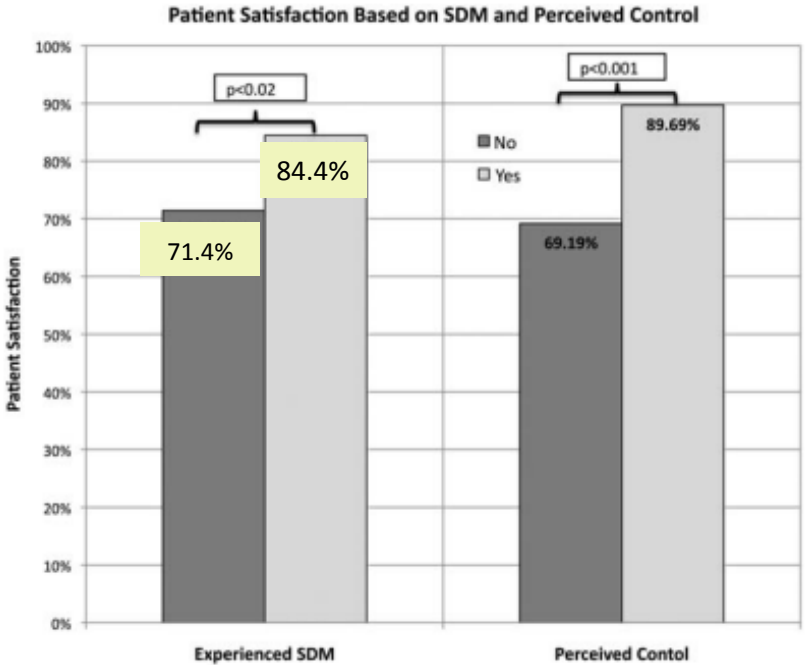
Cáncer de Próstata

Decisión Conjunta Médico - Paciente

Original Article

Shared Decision-Making and Patient Control in Radiation Oncology

Implications for Patient Satisfaction



Shabason et al. Cancer 2014

NCCN Risk Group	Criteria	Approximate Proportion of Newly Diagnosed Cases
Low Risk	T1-T2a Gleason 6 PSA <10	~38%
Intermediate Risk	T2b-T2c Gleason 7 or PSA 10-20	~40%
High Risk	T3-T4 Gleason 8-10 or PSA > 20	~22%

NCCN prostate cancer guidelines
Mahmood J Urol 2014 192:1650

MANEJO DE ACUERDO AL GRUPO DE RIESGO

1) Curar
2) Paciente libre de tratamiento posterior
3) Calidad de vida

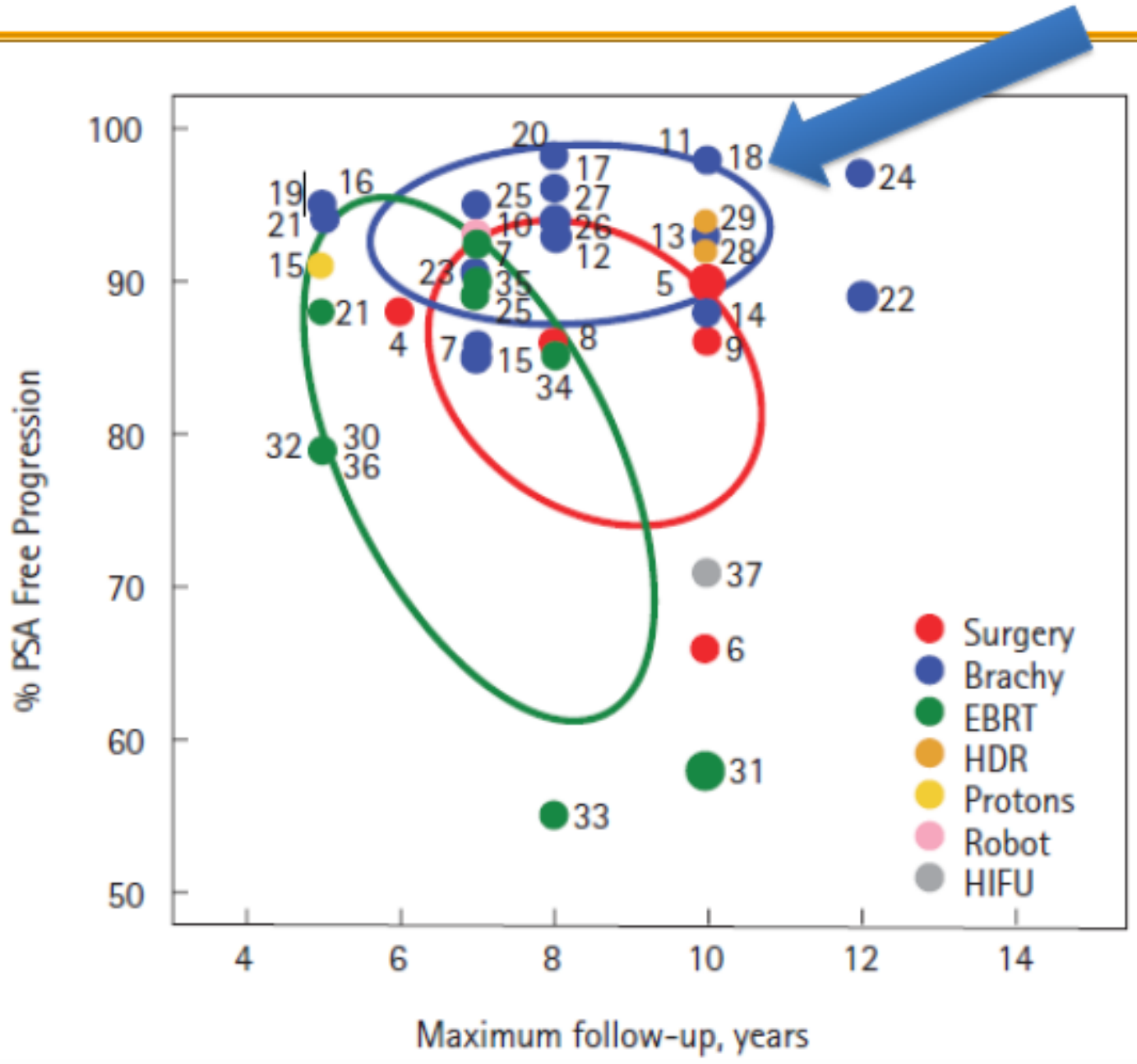
MANEJO

Risk Group	Brachy alone	Combo	+ ADT	Clinical Trial
Low	Yes	No	No	Surveillance
Intermediate 1 risk feature 2 risk features or >50% cores	 Yes No/Optional	 No/Optional Yes	 No Yes 4-6 months	RTOG 0815
High	No	Yes	Yes 6-30 months	RTOG 0924

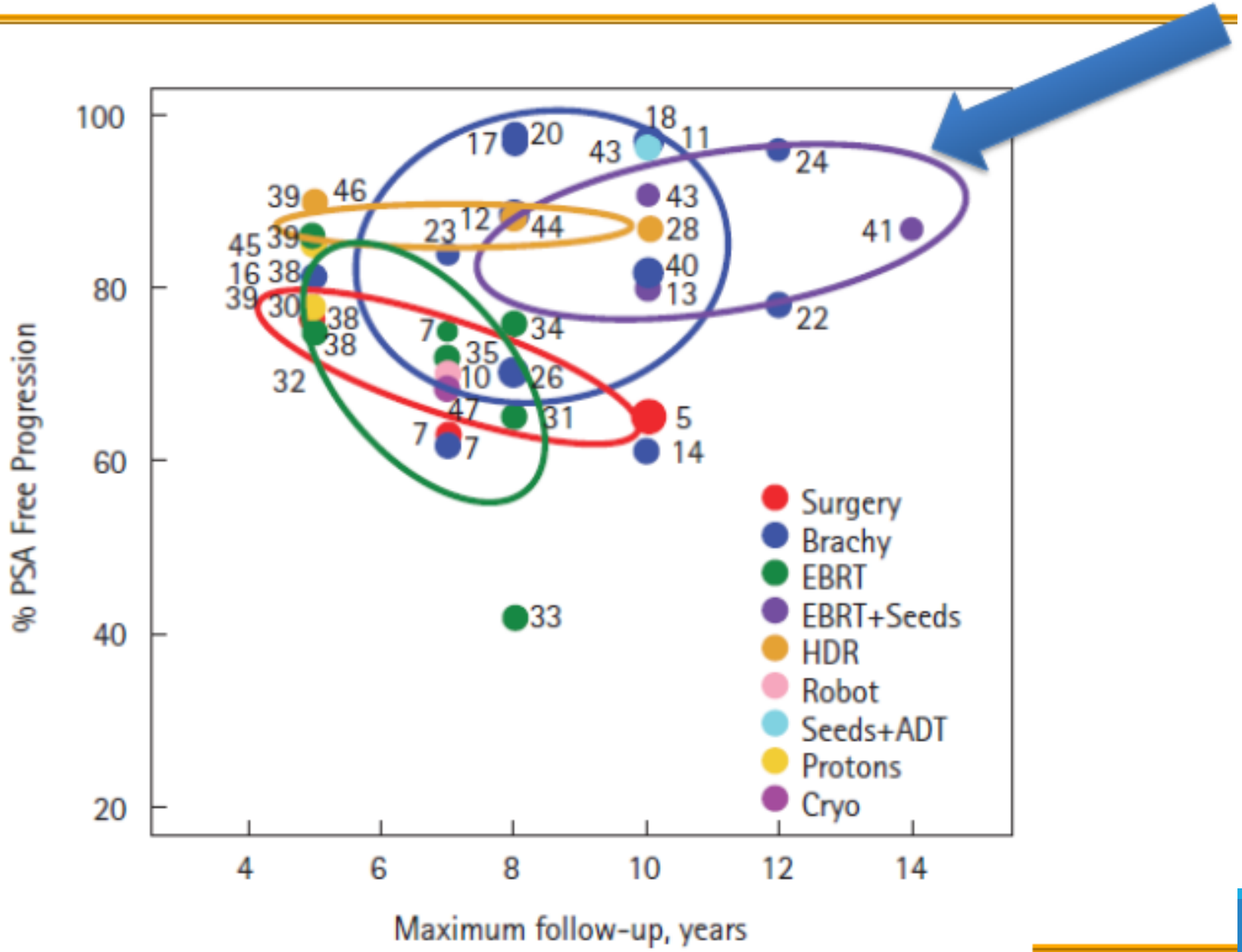
Comparative analysis of prostate-specific antigen free survival outcomes for patients with low, intermediate and high risk prostate cancer treatment by radical therapy. Results from the Prostate Cancer Results Study Group

Peter Grimm[1], Ignace Billiet[2], David Bostwick[3], Adam P. Dicker[4], Steven Frank[5], Jos Immerzeel[6], Mira Keyes[7], Patrick Kupelian[8], W. Robert Lee[9], Stefan Machtens[10], Jyoti Mayadev[11], Brian J. Moran[12], Gregory Merrick[13], Jeremy Millar[14], Mack Roach[15], Richard Stock[16], Katsuto Shinohara[15], Mark Scholz[17], Ed Weber[18]

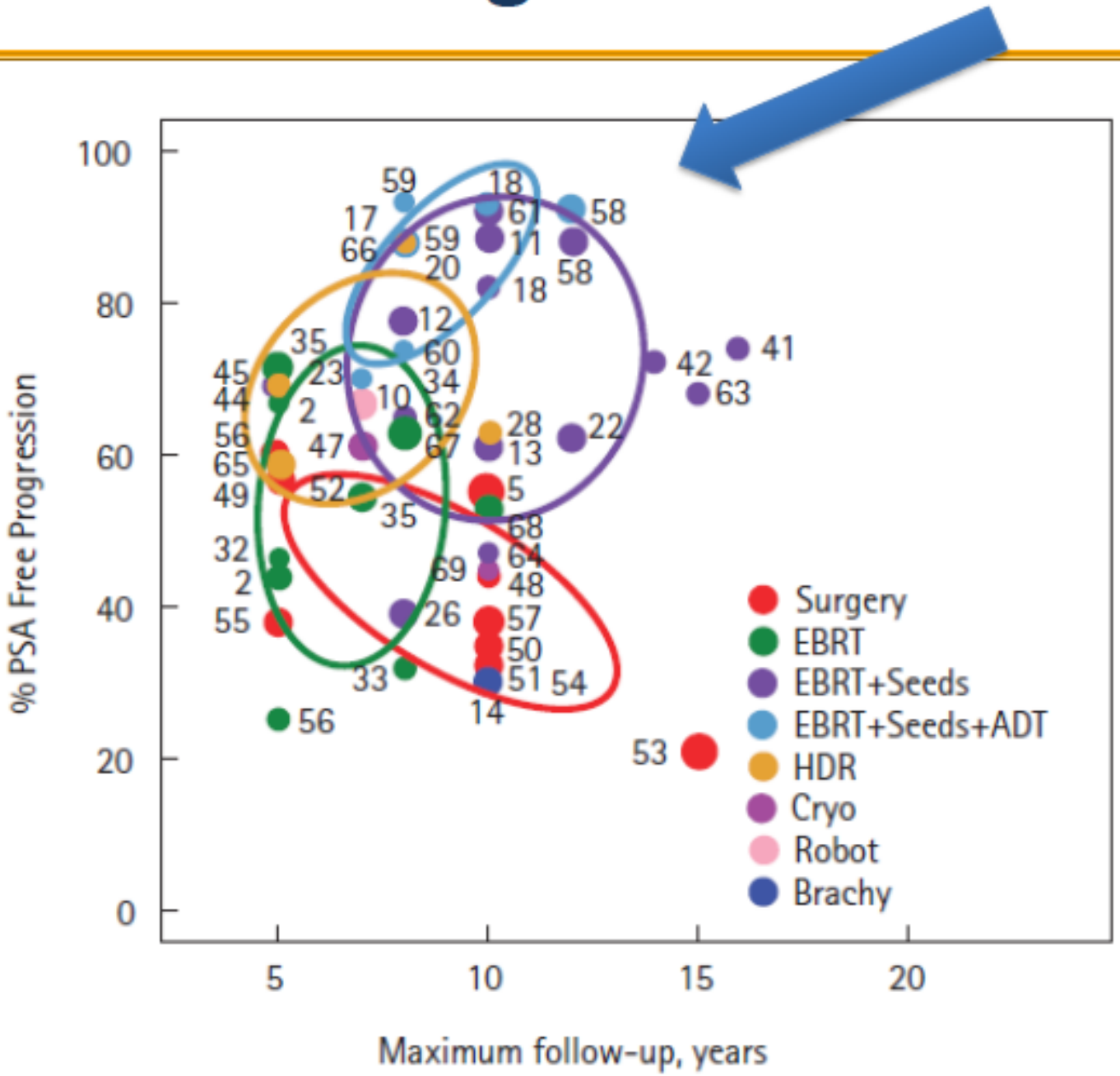
Low Risk


100
90
80
70
60
50
% PSA Free Progression
4
6
8
10
12
14
Maximum follow-up, years
Surgery
Brachy
EBRT
HDR
Protons
Robot
HIFU

Intermediate Risk

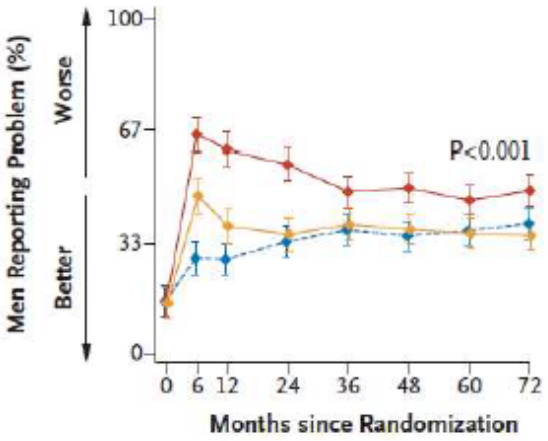


High Risk

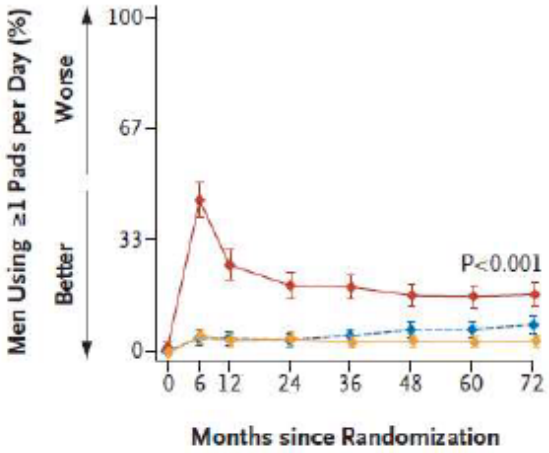

% PSA Free Progression
100
80
60
40
20
0
5
10
15
20
Maximum follow-up, years
Surgery
EBRT
EBRT+Seeds
EBRT+Seeds+ADT
HDR
Cryo
Robot
Brachy

Efectos secundarios TTos

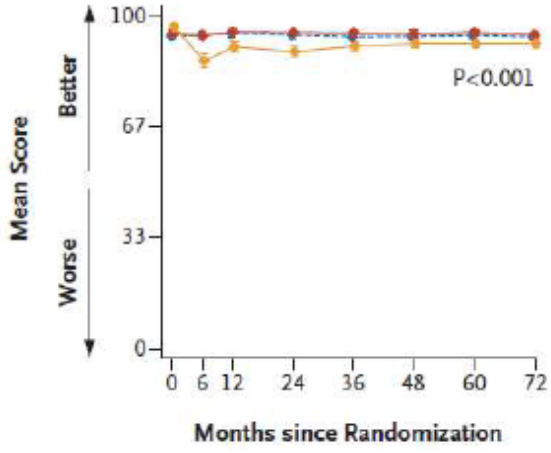
Problem with erectile dysfunction



One or more pads per day



Bowel bother



Radical prostatectomy — Radical radiotherapy — Active monitoring

Donovan NEJM 2016

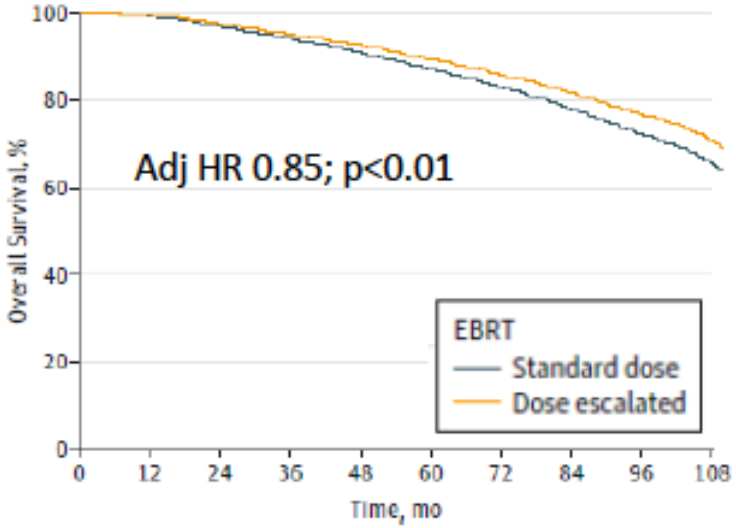
ESCALAR DOSIS????

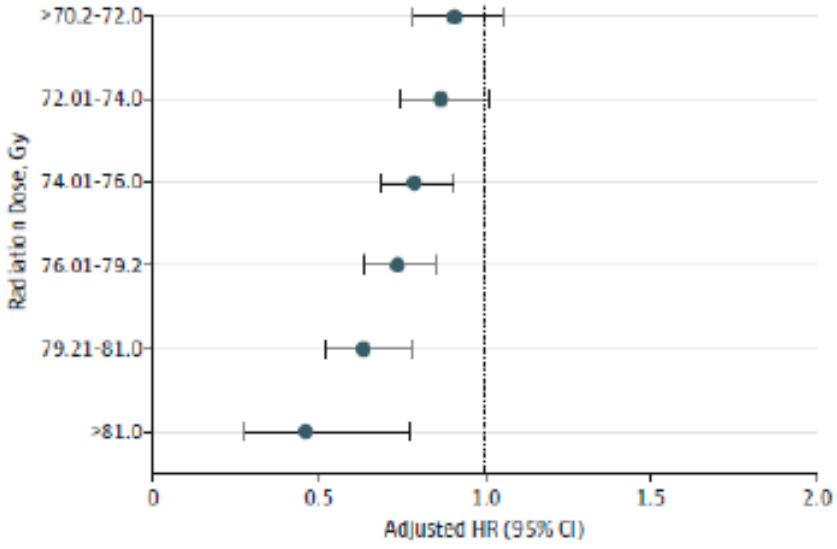
Randomized Dose-escalation Trial	N	Percent Int-risk	Dose (Gy)	ADT	Freedom from biochemical failure	Subgroup Benefit
MD Anderson Kuban 2008	301	45%	70 vs. 78	No	10 yr: 73% vs. 50% p=0.004	PSA > 10
PROG-ACR Zietman 2005	392	37%	70.2 vs. 79.2	No	10 yr: 83% vs. 68% P<0.001	All Low & Int Risk
Dutch Heemsbergen 2014	664	27%	68 vs. 78	21%	10 yr: 61% vs. 43% p=0.046	PSA ≥ 10
MRC RT01 Dearnaley 2014	843	37%	64 vs. 74	5-8 mo	10 yr: 55% vs. 43% p<0.001	All
RTOG 0126 Michalski 2015	1499	100%	70.2 vs. 79.2	No	10 yr: 70% vs. 55% p<0.001	All Int Risk

ESCALAR DOSIS????

NCDB Analysis

- 16,714 men with intermediate-risk disease treated 2004-2006
- For every 2 Gy (above 70Gy), 8% reduction in hazard of death





Kalbasi JAMA Oncol 2015 1:897

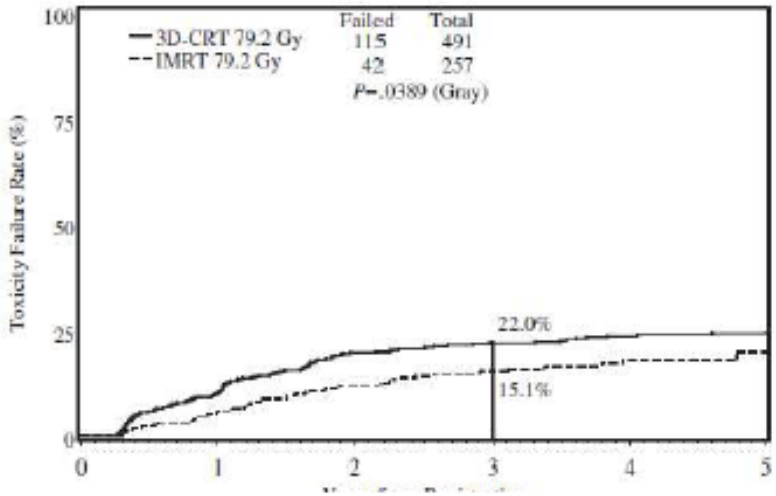
EL ESCALAMIENTO DE DOSIS AUMENTA LA TOXICIDAD GI EN LOS ESTUDIOS…

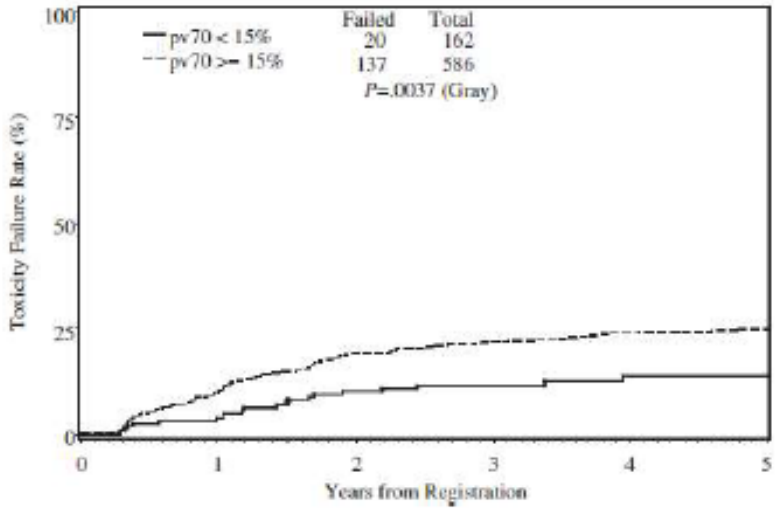
Randomized Dose-escalation Trial	Field design	Dose (Gy)	Late grade 2+ GU toxicity	P-value	Late grade 2+ GI toxicity	P-value
MD Anderson Kuban 2008	Conventional w/ 3DCRT boost	70 78	8% 13%	ns	13% 26%	p=0.013
PROG-ACR Zietman 2005	3DCRT Proton boost	70.2 79.2	18% 20%	ns	8% 17%	p=0.005
Dutch Heemsbergen 2014	3DCRT	68 78	40% 41%	ns	25% 35%	p=0.04
MRC RT01 Dearnaley 2014	3DCRT	64 74	8% 11%	ns	24% 33%	p=0.005
RTOG 0126 Michalski 2015	3DCRT or IMRT	70.2 79.2	10% 15%	p=0.001	16% 22%	p=0.006

LIMITAR LA DOSIS AL RECTO PUEDO DISMINUIR LA TOXICIDAD TARDIA GI LUEGO DEL ESCALAMIENTO DE DOSIS…

- Illustrated by RTOG 0126

3DCRT vs IMRT	V70 < 15% vs >= V70 < 15%





Michalski IJROBP 2013 887(5):932

SUPRESIÓN ANDRÓGENO

JOURNAL OF CLINICAL ONCOLOGY

ORIGINAL REPORT

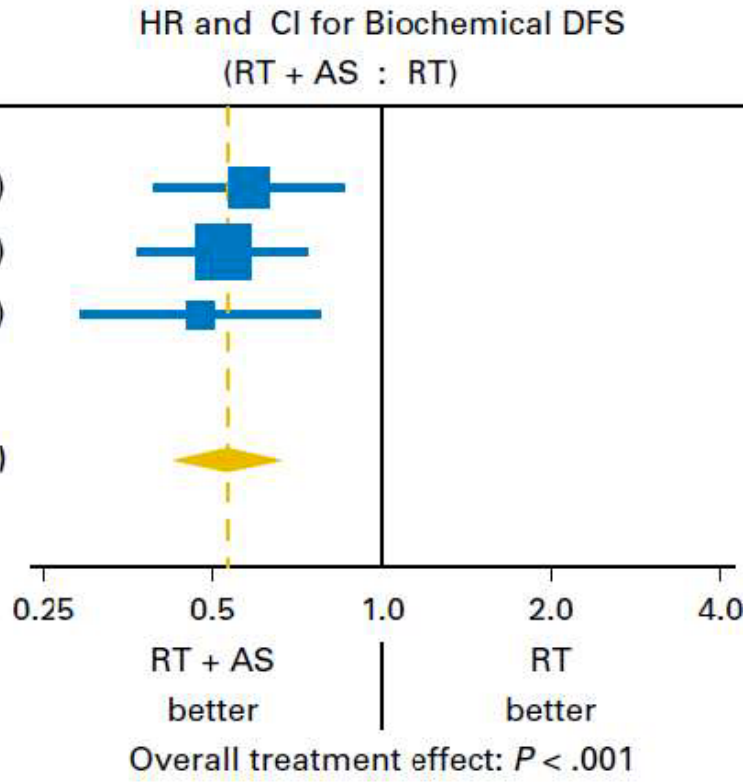
Short Androgen Suppression and Radiation Dose Escalation for Intermediate- and High-Risk Localized Prostate Cancer: Results of EORTC Trial 22991

Michel Bolla, Philippe Maingon, Christian Carrie, Salvador Villa, Petros Kitsios, Philip M.P. Poortmans, Santhanam Sundar, Elzbieta M. van der Steen-Banasik, John Armstrong, Jean-François Bosset, Fernanda G. Herrera, Bradley Pieters, Annerie Slot, Amit Bahl, Rahamim Ben-Yosef, Dirk Boehmer, Christopher Scrase, Laurette Renard, Emad Shash, Corneel Coens, Alphonsus C.M. van den Bergh, and Laurence Collette

See accompanying editorial doi:10.1200/JCO.2015.66.2320

SUPRESIÓN ANDRÓGENO…

RT Dose	Events/Patients RT + AS	RT	HR (95% CI)	
70 Gy	41/101	66/100	0.58	(0.39 to 0.86)
74 Gy	52/212	89/209	0.52	(0.37 to 0.73)
78 Gy	25/97	46/100	0.48	(0.29 to 0.77)
Total	**118/410 (28.8%)**	**201/409 (49.1%)**	**0.53**	**(0.42 to 0.67)**



…Aun Beneficios con Escalamiento de Dosis

ASCENDE-RT ROL DE RTE + BATD

NCCN IR and HR risk group

Randomized

DE-EBRT arm
12m ADT, 8m neo-adjuvant
46 Gy whole pelvis EBRT
78 Gy 3-DCRT boost

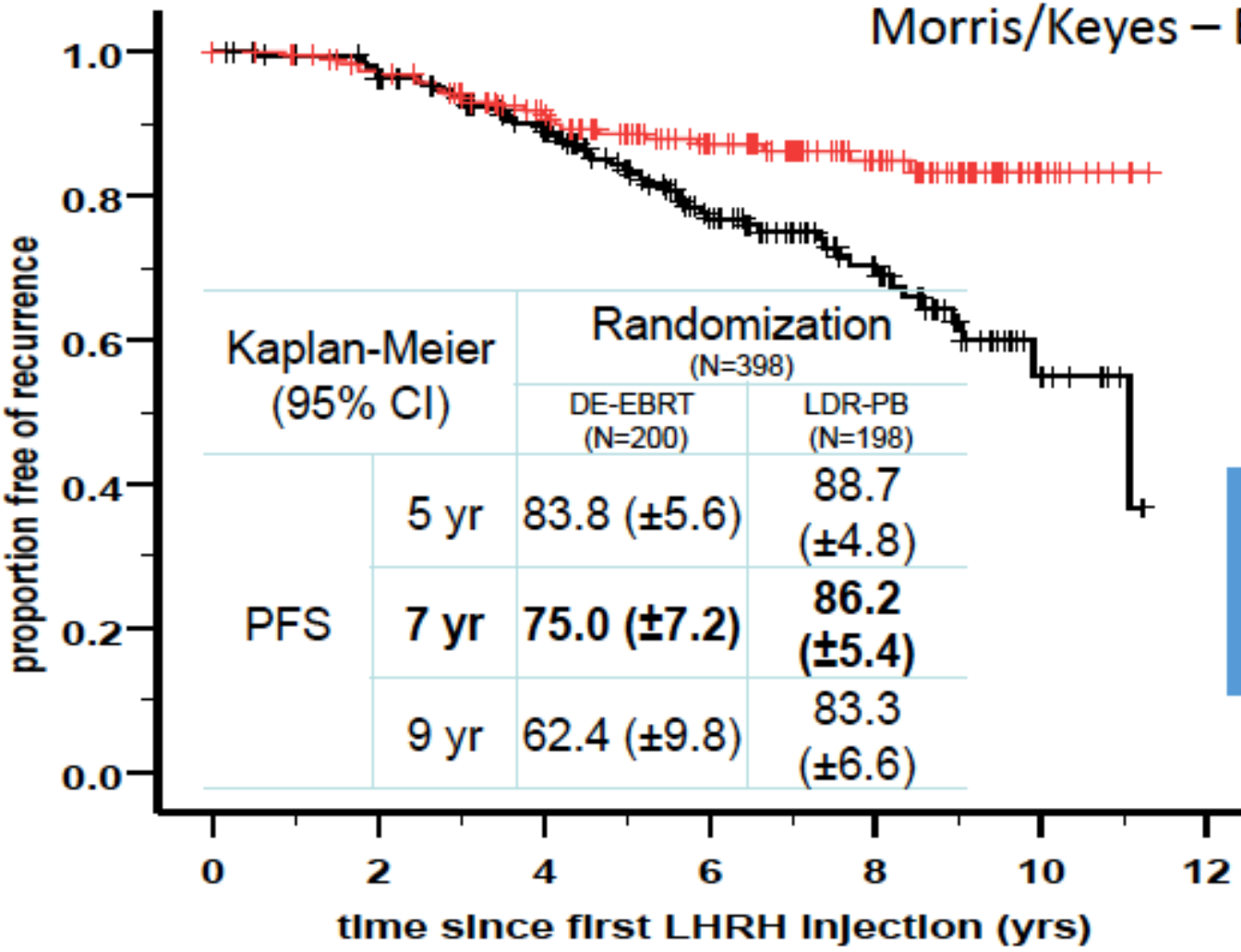
LDR-PB arm
12m ADT, 8m neo-adjuvant
46 Gy whole pelvis EBRT
LDR 115 Gy I^{125} boost

FU:
Clinical visits: q6 mo – to 5 y and annually afterwards
PSA and Testosterone - q6mo

Morris/Keyes – BC Cancer Agency

Results: Biochemical PFS

Intent-to-treat analysis of the primary endpoint



Kaplan-Meier (95% CI)		Randomization (N=398) DE-EBRT (N=200)	LDR-PB (N=198)
PFS	5 yr	83.8 (±5.6)	88.7 (±4.8)
	7 yr	**75.0 (±7.2)**	**86.2 (±5.4)**
	9 yr	62.4 (±9.8)	83.3 (±6.6)

Absolute difference
5y – 4.9%
7y – 11.2%
9y – 20.95%

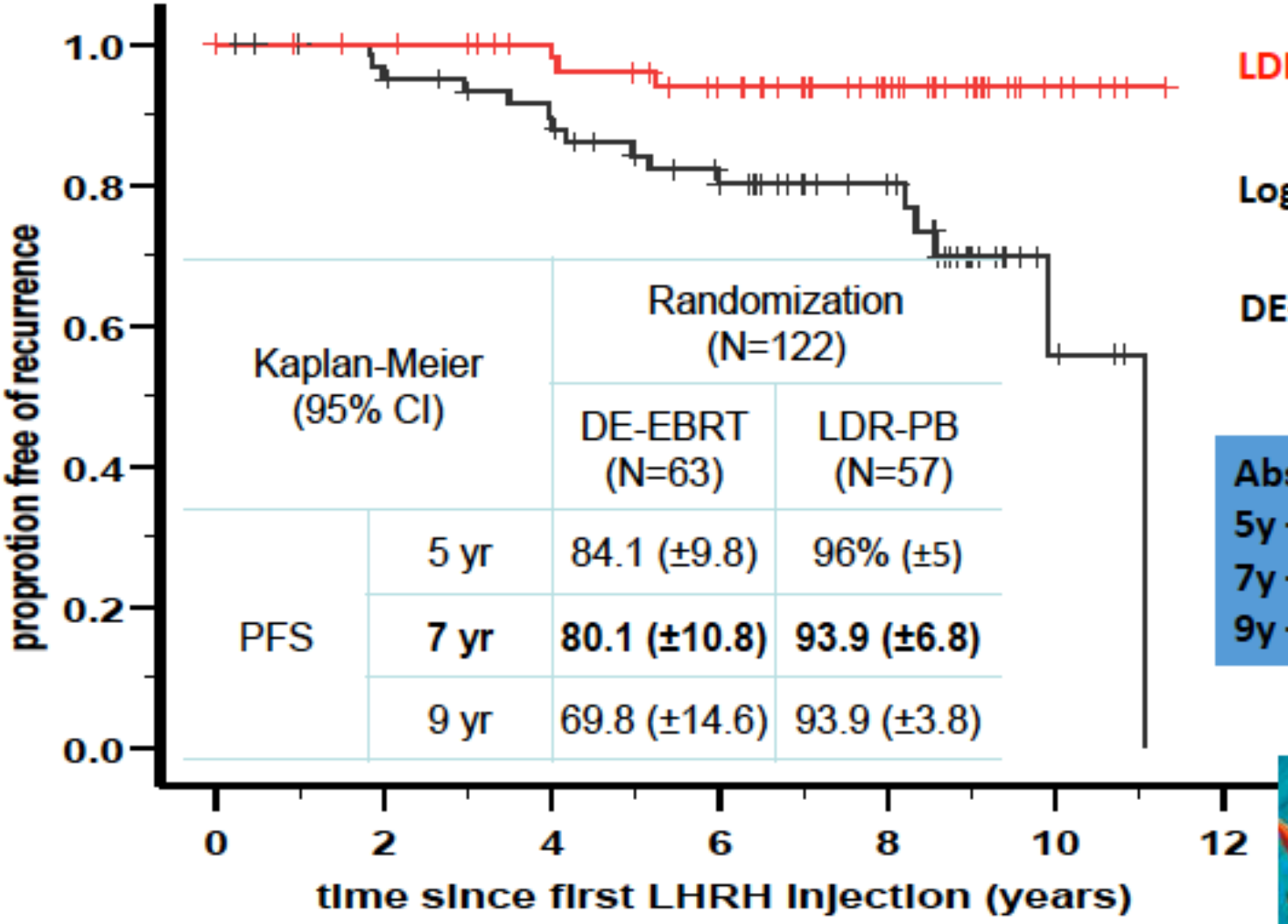
Risk Groups

- 68% NCCN High Risk
- 32% NCCN Intermediate Risk (most were unfavorable w/>50% PPC)

PFS by NCCN Risk Group

Intermediate-risk N=122

Morris/Keyes – BC Cancer Agency



Kaplan-Meier (95% CI)		Randomization (N=122) DE-EBRT (N=63)	LDR-PB (N=57)
PFS	5 yr	84.1 (±9.8)	96% (±5)
	7 yr	**80.1 (±10.8)**	**93.9 (±6.8)**
	9 yr	69.8 (±14.6)	93.9 (±3.8)

LDR-PB ARM

Log rank P <0.001

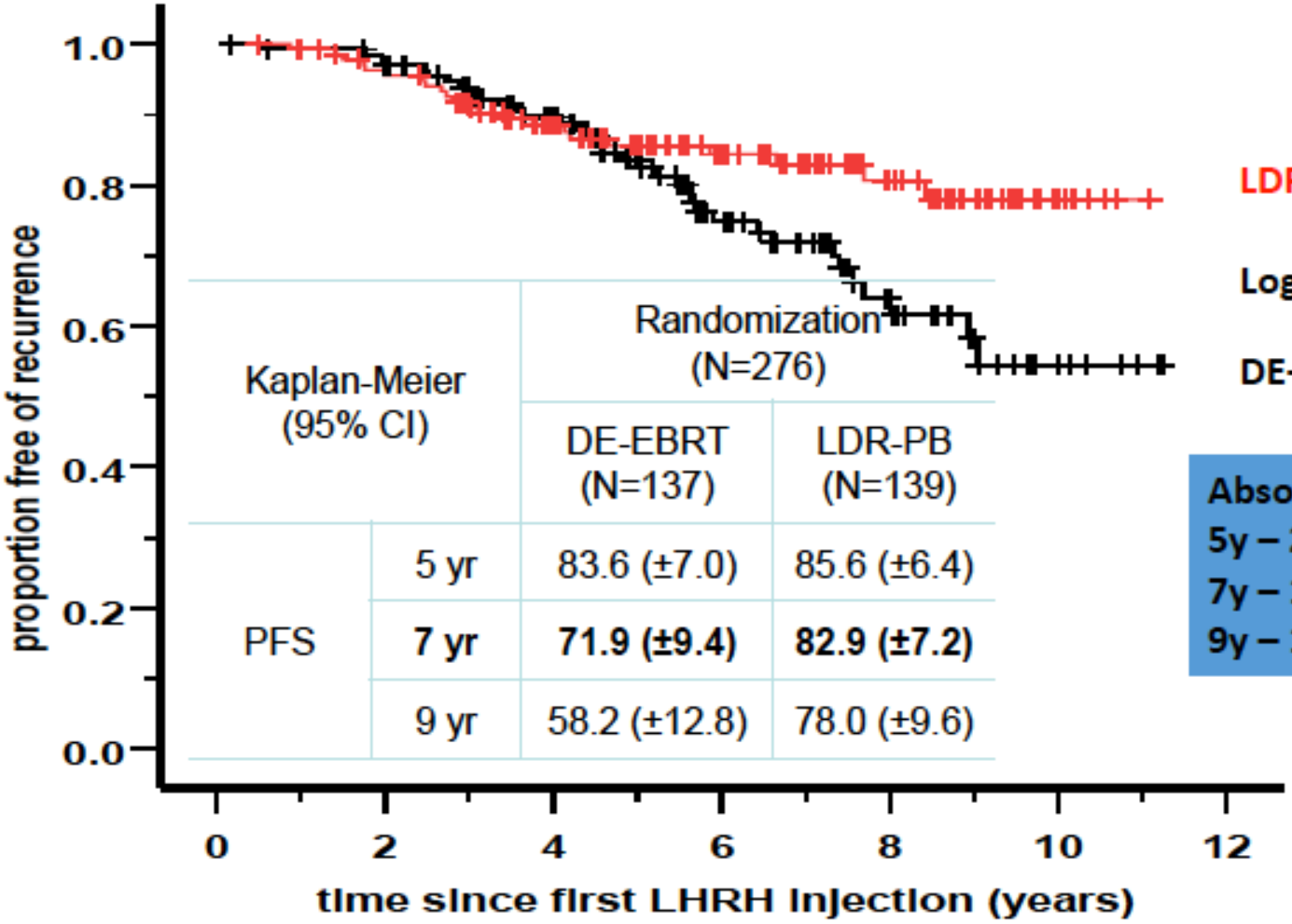
DE-EBRT ARM

Absolute difference
5y – 11.9%
7y – 13.8%
9y – 24.1%

PFS by NCCN Risk Group

High-Risk N=276

Morris/Keyes – BC Cancer Agency



Kaplan-Meier (95% CI)		Randomization (N=276) DE-EBRT (N=137)	LDR-PB (N=139)
PFS	5 yr	83.6 (±7.0)	85.6 (±6.4)
	7 yr	**71.9 (±9.4)**	**82.9 (±7.2)**
	9 yr	58.2 (±12.8)	78.0 (±9.6)

LDR-PB ARM

Log rank P = 0.05

DE-EBRT ARM

Absolute difference
5y – 2%
7y – 11.%
9y – 19.8%

Series	Risk Group	# patients	Cohorts studied	PSA-RFS
Kohr et al (2013) Melbourne	Intermediate-High Risk	688	EBRT + HDR vs EBRT 74Gy	80% vs 71% @5 Yrs (p=0.001) in favor of CMT
Shilkrut et al (2013) Michigan	High Risk	955	BRT+/-EBRT vs 75-81 Gy EBRT	86% vs 60%@ 8 Yrs (p=0.003) in favor of CMT
Spratt et al (2014) MSKCC	Intermediate	870	BRT+ EBRT vs 86.4 Gy IMRT	92% vs 81% @ 7 yrs (p<0.001) in favor of CMT
Marina et al (2014) Beaumont	Intermediate Risk	1016	HDR+ EBRT vs 77 Gy IMRT	91% vs 86% @ 8 yrs
Marina et al (2014) Beaumont	Unfavorable Intermediate Risk Subset	305	HDR+EBRT vs 77 Gy EBRT	96% vs 87% @ 5 yrs (p=0.002) in favor of CMT

Series	Risk Group	# patients	Cohorts studied	Survival Outcome
Spratt et al (2014) MSKCC	Intermediate	870	BRT+ EBRT vs 86.4 Gy IMRT	DMFS: 97% vs 93@ 7yrs in favor of CMT
Shilkrut et al (2013) Michigan	High Risk	955	BRT+/-EBRT vs 75-81 Gy EBRT	PCSM: 7% vs 13% in favor of CMT
Amini et al (2016) NCDB	Intermediate Risk	3838- CMT 8779- EBRT	EBRT + BRT vs dose escalated EBRT	OS: 85.5% vs 78.4% @ 7 yrs in favor of CMT
Amini et al (2016) NCDB	High Risk	1989-CMT 5673- EBRT	EBRT + BRT vs dose escalated EBRT	OS: 81% vs 71% @ 7 yrs in favor of CMT
Shen et al (2012) SEER Database	High Risk (High Grade)	12, 745	BT+ EBRT vs EBRT	PCSM: 13% vs 21% in favor of CMT

ÓRGANOS DE RIESGO

- VEJIGA
- RECTO
- BULBO PENEANO
- CABEZAS FEMORALES

ÓRGANOS DE RIESGO

RESTRICCIONES BASADO EN	QUANTEC - FRACCIONAMIENTO CONVENCIONAL Consenso RTOG GU, RTOG 0630
Cabezas Femorales	V50< 5%
Vejiga	Dmax <65 Gy, V65< 50%, V70<35%, V75< 25%, V80<15%
Recto	V50<50%, V60<35%, V65<25%, V70<20%, V75<15%
Bulbo Peneano	Media <50 Gy, D90 <50, D60 <70, Puntos Calientes no mayores dosis prescrita
Gonadas	V3 <50%
RESTRICCIONES BASADO EN	**QUANTEC - HIPOFRACCIONAMIENTO**
Cabezas Femorales	V40< 2%
Vejiga	V60< 25%, V56<35%, V52< 50%
Recto	V60<15%, V56<20%,V52<25%, V48<35%,v40<50%

RTOG: Radiation Therapy Oncology Group, QUANTEC: Quantitative Analysis of Normal Tissue Effects in the Clinic

TÉCNICAS Y DOSIS DE TRATAMIENTO DE RTE

- 2D
- 3D
- IMRT - VMAT
- BATD – SBRT - PROTONES

DOSIS

1. 60 - 66Gy post operatorio
2. 66 - 74 Gy en RBq
3. >74 -81 Gy (en TTO)

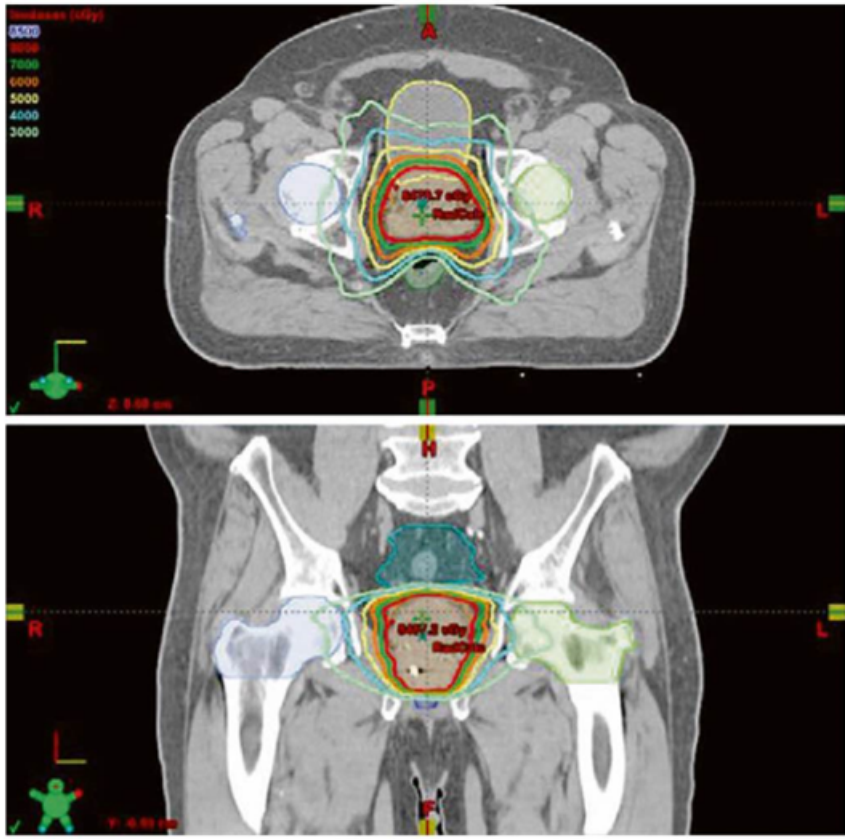
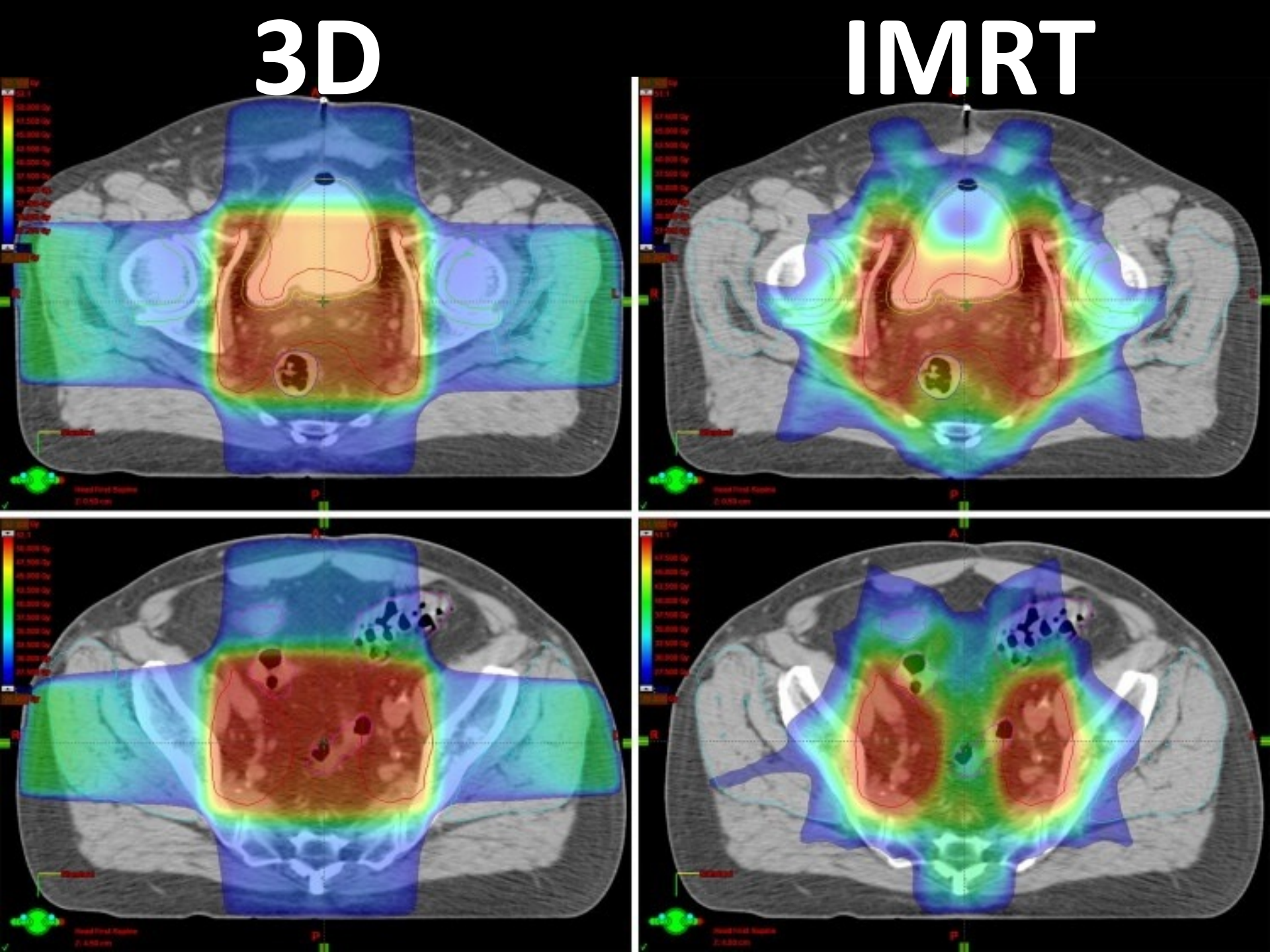
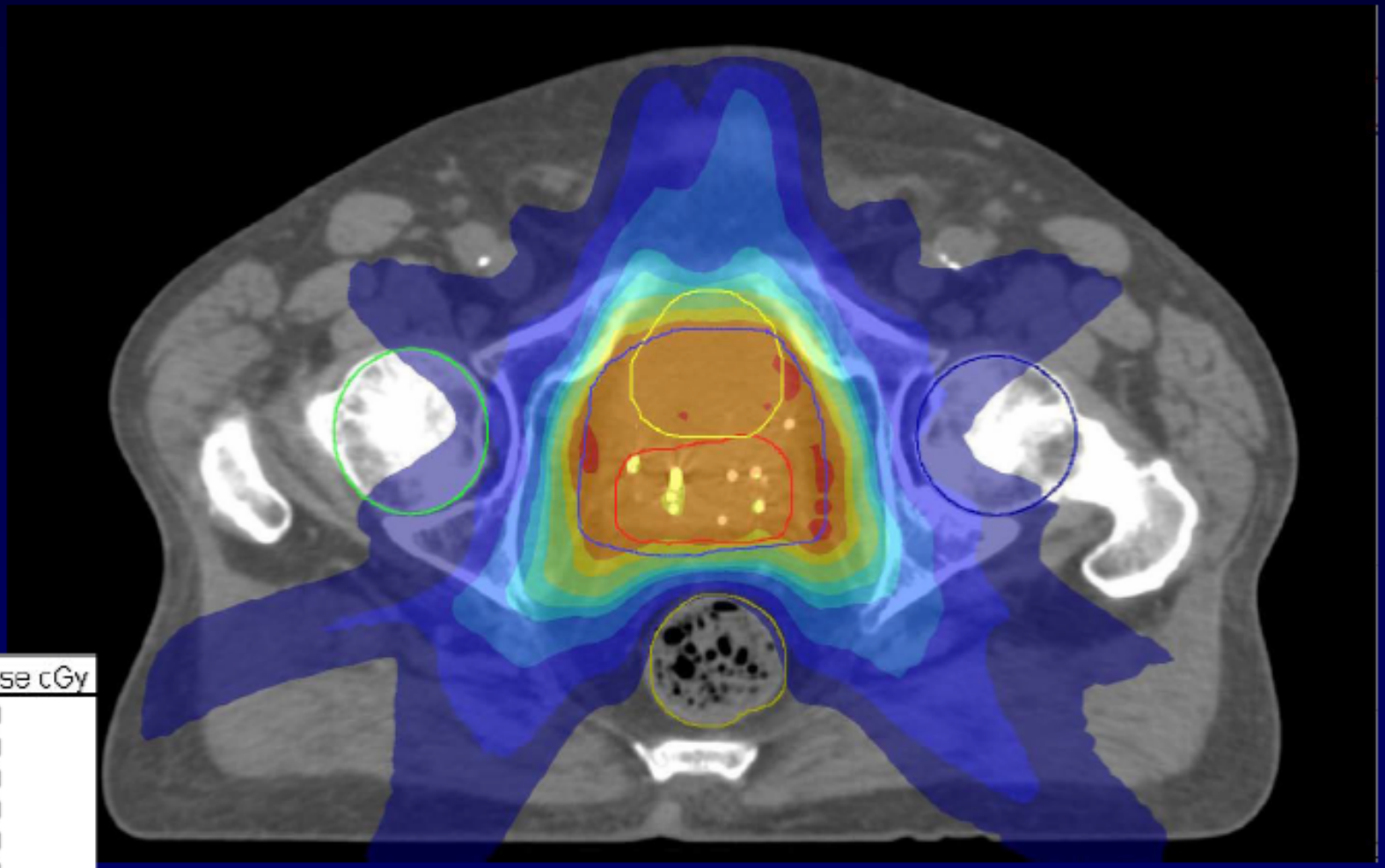


Fig. 19.2 Dose distribution and DVH for a typical IMRT plan prescribing 80 Gy in 40 fractions to the PTV

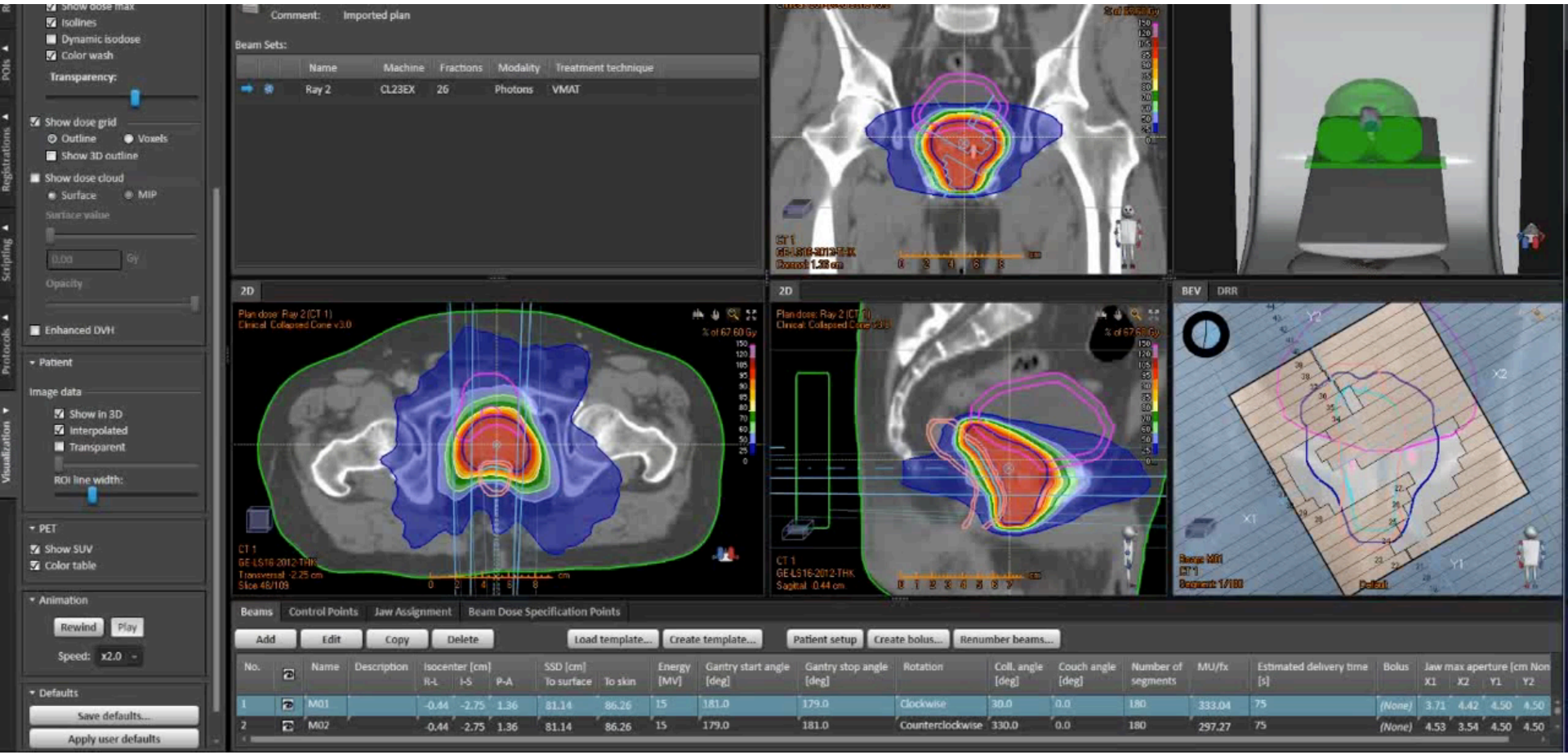

3D
IMRT

Monaco VMAT

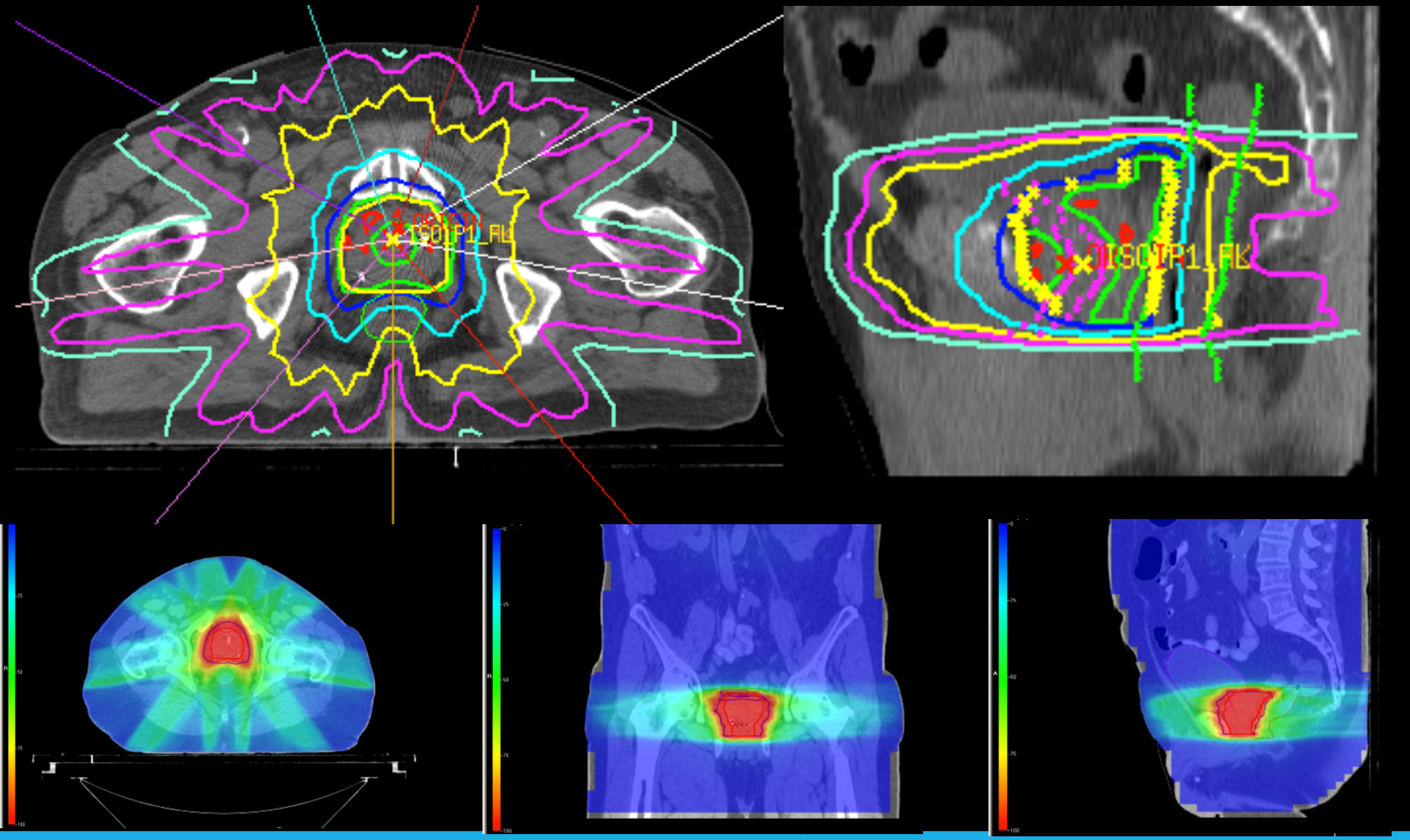
Case #2 - Prostate



- 180 cGy/fraction, 678 MU
- Delivery time = 3 min 54 sec


Comment: Imported plan
Beam Sets:
Name Machine Fractions Modality Treatment technique
Ray 2 CL23EX 26 Photons VMAT
Show dose max
Isolines
Dynamic isodose
Color wash
Transparency:
Show dose grid
Outline Voxels
Show 3D outline
Show dose cloud
Surface MIP
Surface value
Gy
Opacity
Enhanced DVH
Patient
Image data
Show in 3D
Interpolated
Transparent
ROI line width:
PET
Show SUV
Color table
Animation
Rewind Play
Speed: x2.0
Defaults
Save defaults...
Apply user defaults
2D
Plan dose: Ray 2 (CT 1)
Clinical: Collapsed Cone v3.0
CT 1
GE-LS16-2012-THK
Transversal -2.25 cm
Slice 48/109
2D
Sagittal -0.44 cm
BEV DRR
Beams Control Points Jaw Assignment Beam Dose Specification Points
Add Edit Copy Delete Load template... Create template... Patient setup Create bolus... Renumber beams...
No. Name Description Isocenter [cm] R-L I-S P-A SSD [cm] To surface To skin Energy [MV] Gantry start angle [deg] Gantry stop angle [deg] Rotation Coll. angle [deg] Couch angle [deg] Number of segments MU/fx Estimated delivery time [s] Bolus Jaw max aperture [cm] X1 X2 Y1 Y2
1 M01 -0.44 -2.75 1.36 81.14 86.26 15 181.0 179.0 Clockwise 30.0 0.0 180 333.04 75 (None) 3.71 4.42 4.50 4.50
2 M02 -0.44 -2.75 1.36 81.14 86.26 15 179.0 181.0 Counterclockwise 330.0 0.0 180 297.27 75 (None) 4.53 3.54 4.50 4.50

SBRT



Brachytherapy v. SBRT Prostate Virtual Dosimetry

Table 1
Dosimetric comparisons for *normal tissue–prioritized* plans

Metric	SBRT	±SD	HDR	±SD	*p*-Value
PTV V_{100} (%)	93.08	3.20	93.78	1.78	NS
PTV V_{150} (%)	42.86	7.70	40.32	6.47	NS
PTV V_{200} (%)	0.00	0.00	15.18	3.05	0.00
Rectum max (%)	99.42	2.79	94.24	5.24	0.05
Rectum $D_{2\,cc}$ (%)	71.14	4.78	60.84	5.90	0.07
Mean rectum dose (%)	28.43	4.00	27.12	4.03	NS
Bladder max (%)	110.06	9.92	104.17	30.05	NS
Bladder $D_{2\,cc}$ (%)	78.78	6.41	58.30	9.58	0.08
Urethra max (%)	115.80	5.40	119.28	3.98	NS
Urethra $D_{1\,cc}$ (%)	75.17	29.72	87.72	12.87	NS
Urethra mean (%)	84.83	13.11	95.04	9.96	0.08

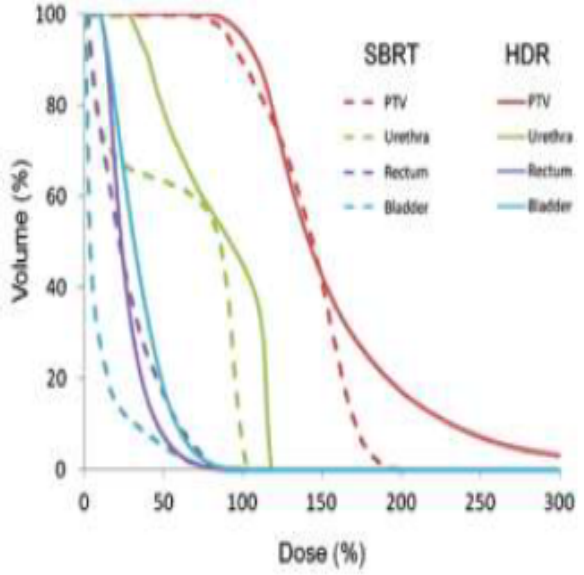
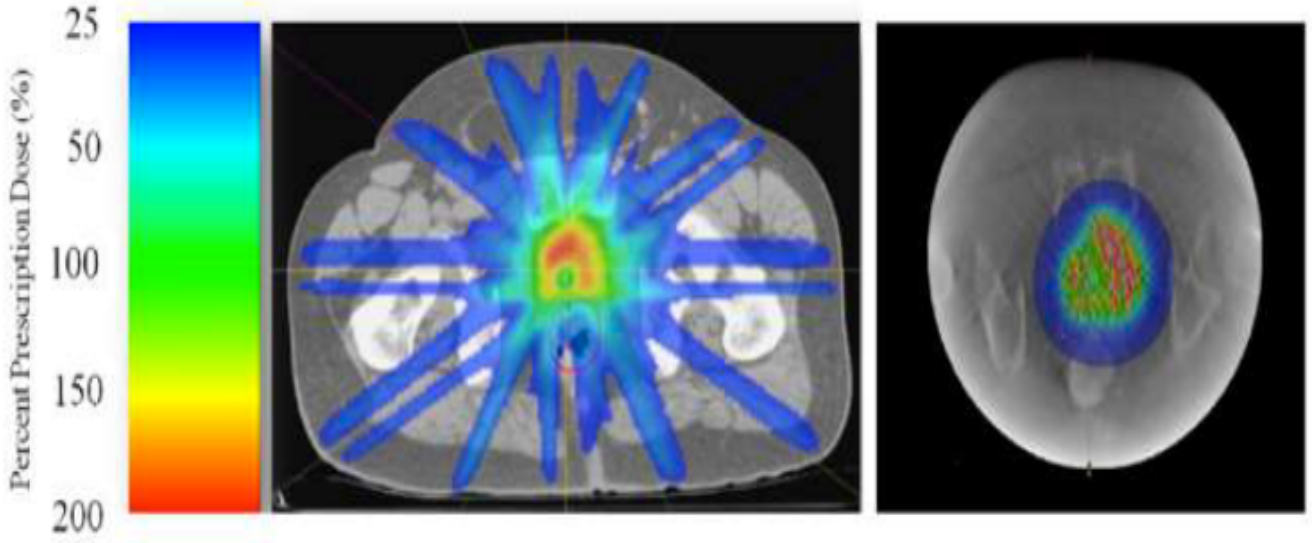
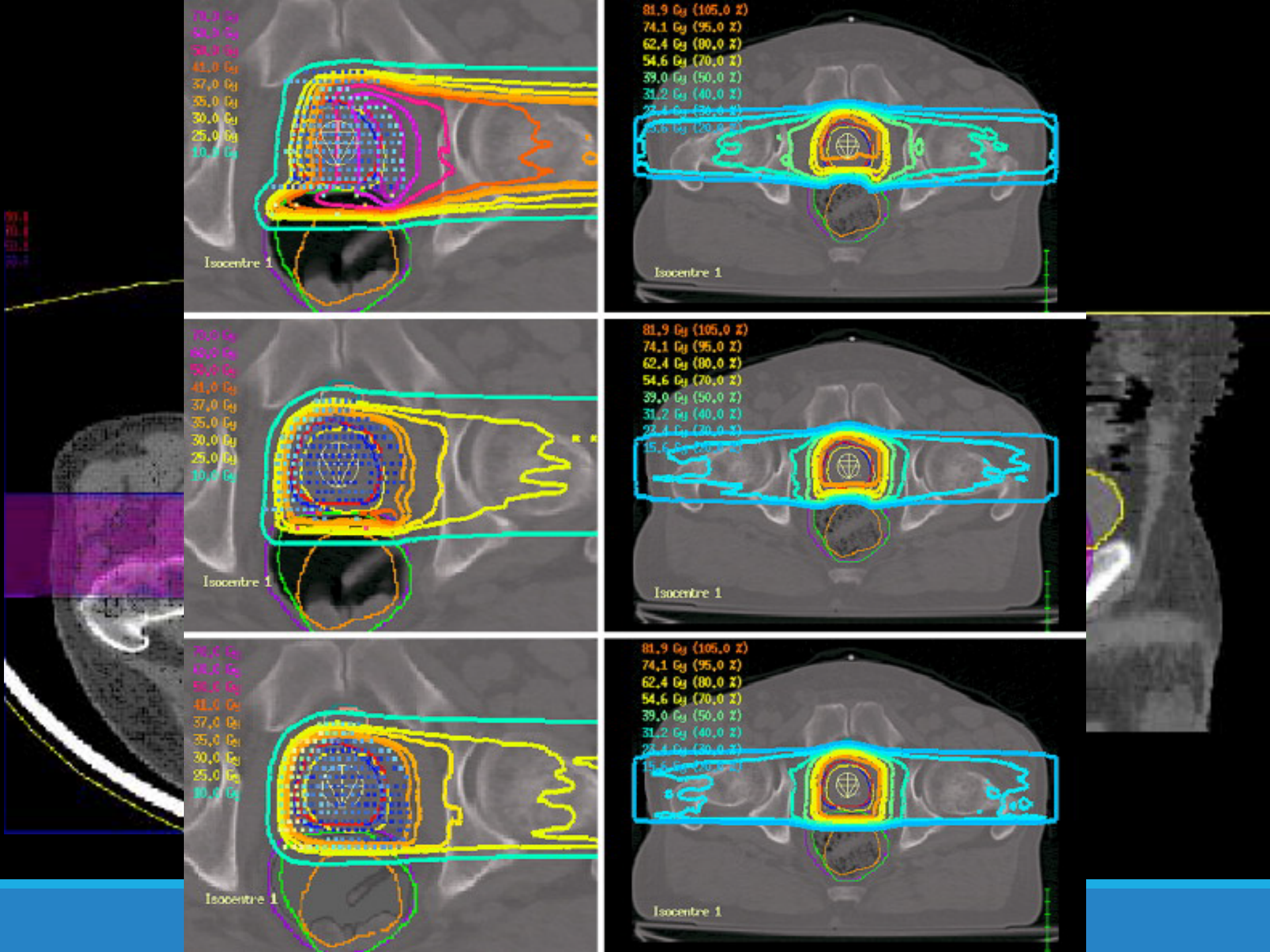


Fig. 2. Representative dose–volume histogram for the normal tissue–prioritized plan. SBRT = stereotactic body radiotherapy; HDR = high-dose rate; PTV = planning target volume.



HDR Brachytherapy achieves significantly higher intraprostatic Doses compared with SBRT

Spratt et al. Brachytherapy. 2013.


81.9 Gy (105.0 %)
74.1 Gy (95.0 %)
62.4 Gy (80.0 %)
54.6 Gy (70.0 %)
39.0 Gy (50.0 %)
31.2 Gy (40.0 %)
Isocentre 1
Isocentre 1
Isocentre 1
Isocentre 1

TOXICIDAD

Después de una cirugía: Disfunción erectil, incontinencia urinaria, constricción uretral.

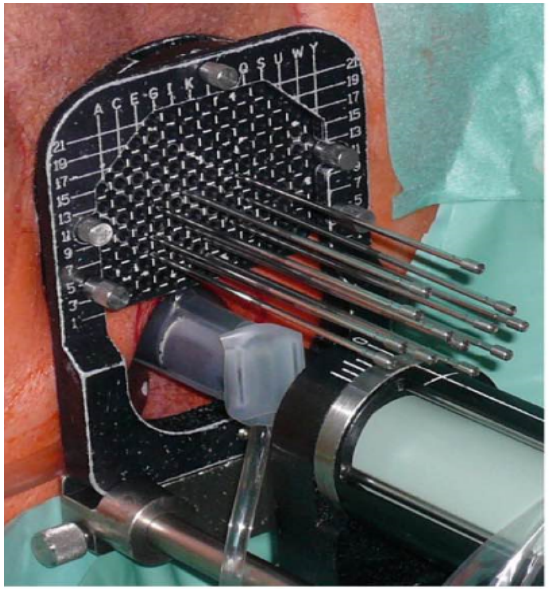
El 33% de pacientes que fueron a prostatectomía radical tuvieron incontinencia urinaria.

Efectos agudos: Fatiga, frecuencia/ urgencia, proctitits / diarrea.

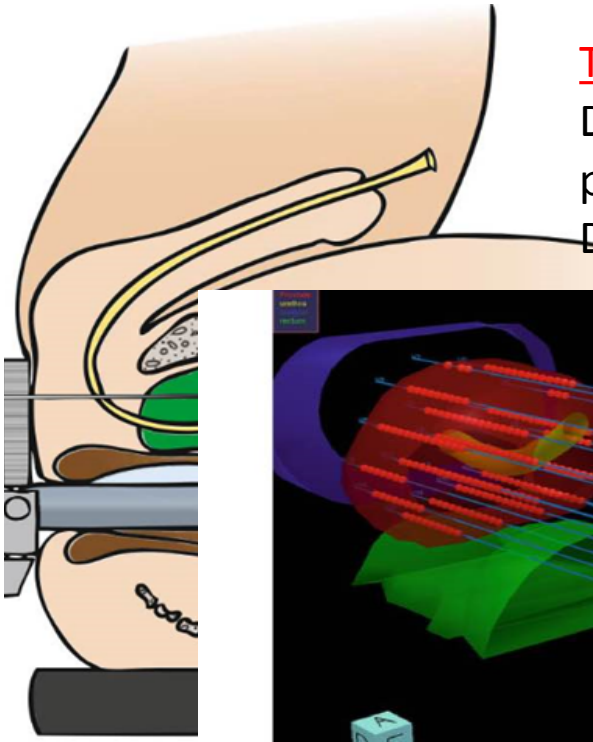
Efectos tardíos: Disfunción eréctil, cistitis, proctitis.

IMRT, en numerosos estudios retrospectivos, sugiere que el ≥G3 GU /GI, de toxicidad es ≤1%.

BRAQUITERAPIA DE ALTA TASA DE DOSIS



RECONSTRUCCION DIGITAL



Transductor endorectal

Determinar área prostática a irradiar.

Delimitar OAR (Uretra)

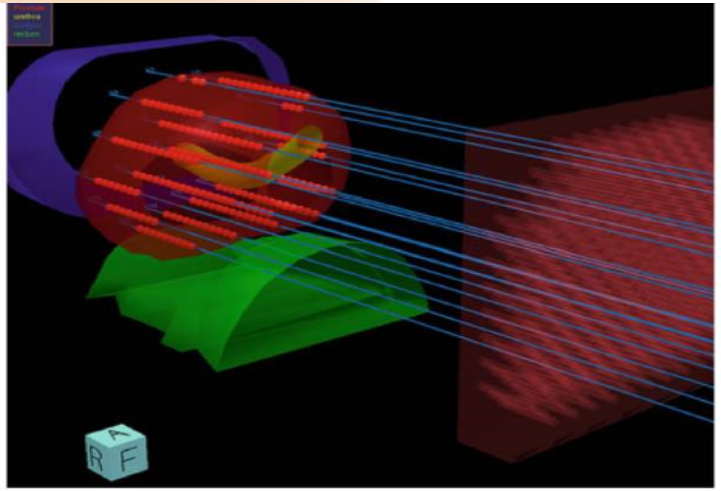
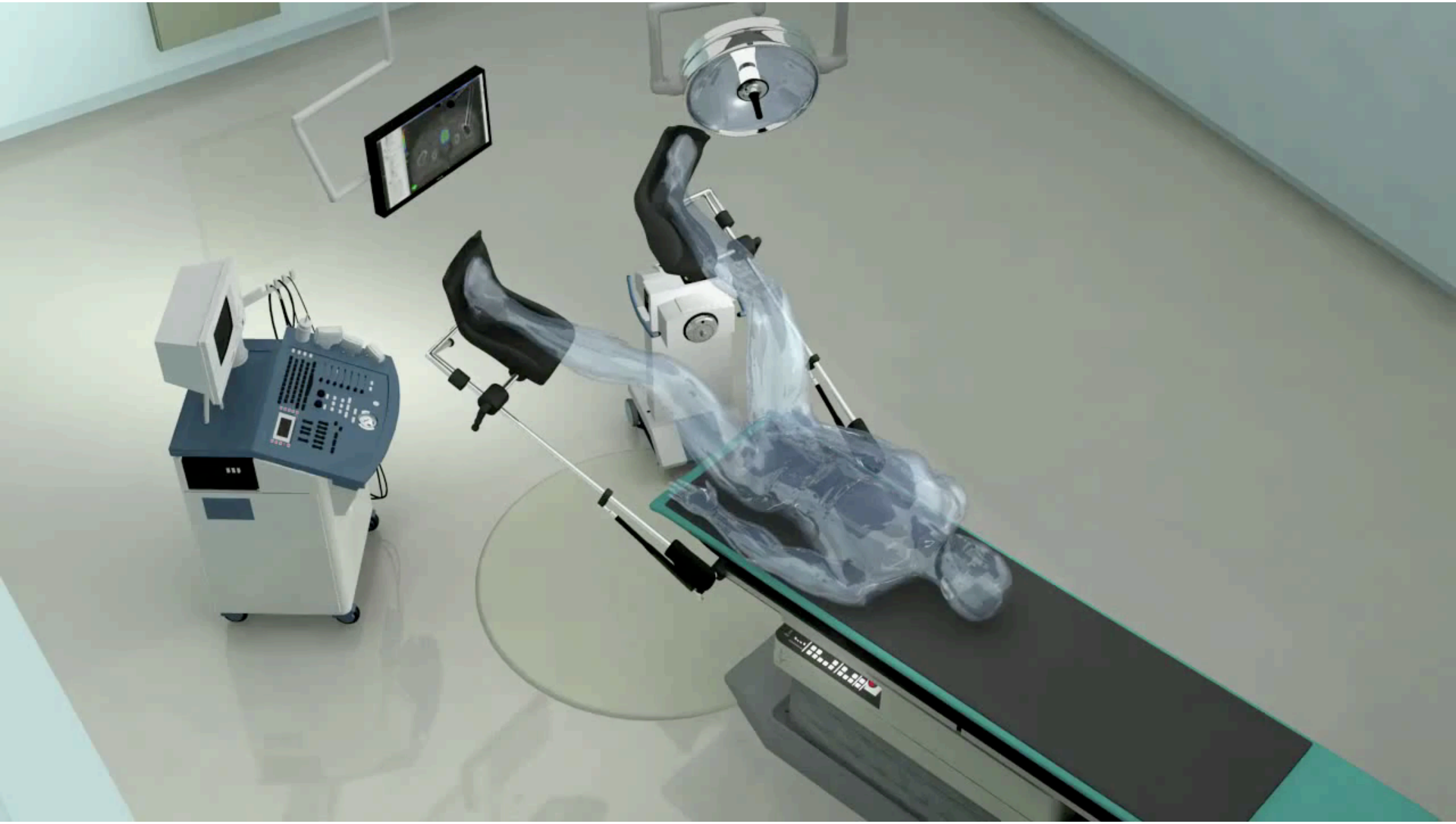


Fig. 1 Three-dimensional reconstruction of the prostate, urethra, rectum, and bladder with ideal template needle trajectories for TRUS-guided implantation as calculated for pre-planning by the real-time treatment planning system SWIFT/Oncentra Prostate (Nucletron B.V., Veenendaal, The Netherlands). The virtual perineal template is displayed on the *right side*



BATD

	NCCN 2016	ABS 2012
Low Risk **cT1c/T2a & Gl 6 & PSA<10**	Brachy alone	Brachy alone
Intermediate **cT2b/c or Gl 7 or PSA 10.1-20**	Brachy + EBRT +/- ADT **Brachy alone**	Brachy + EBRT +/- ADT Brachy alone for select pts
High Risk **cT3a or Gl 8-10 or PSA >20**	Brachy+EBRT+ADT	Brachy+EBRT+ADT

Representative Dose-fractionations and BEDs of SBRT or HDR

		Physical dose			BED (Gy)		EQD_{2Gy} (Gy)	
Method	Author	Dose/fr (Gy)	No. of fractions	Total dose (Gy)	α/β =1.5	α/β =3.0	α/β =1.5	α/β =3.0
SBRT	McBride (multicenter, prospective)	7.25	5	36.25	211	124	91	74
		7.5	5	37.5	225	131	96	79
SBRT	Katz	7	5	35	198	117	85	70
		7.25	5	36.25	211	124	91	74
SBRT	King (multicenter, pooled)	7-8, Median 7.25	5	35-40, Median 36.25	198	117	85	70
					253	147	109	88
HDR	Yoshioka	6	9	54	270	162	116	97
HDR	Yoshioka	6	8	48	240	144	103	86
HDR	Yoshioka	6.5	7	45.5	243	144	104	86
HDR	Rogers	6.5	6	39	208	124	89	74
HDR	Demanes	7	6	42	238	140	102	84
HDR	Mark	7.5	6	45	270	158	116	95
HDR	Martinez	9.5	4	38	279	158	119	95
HDR	Zamboglou	11.5	3	34.5	299	167	128	100
HDR	Hoskin	13	2	26	251	139	108	83
HDR	Ghilezan	13.5	2	27	270	149	116	89
HDR	Hoskin	19	1	19	260	139	111	84
IMRT	Zelefsky	1.8	48	86.4	190	138	81	83

Desenlaces: HDR Monoterapia...

Monotherapy: Select series with long term outcome

# of Series	N	Follow-up	Biochemical Control		
			Low	Intermediate	High
6	1435	60 (53-65) months	85-97%	75-93%	79-93%

Shah, Hoskin, Zamboglou, Yoshioka, Demanes

Desenlaces: RTE + HDR

Author/Design	# of patients	Follow up	BC		MFS		Late Toxicity ≥ Grade 3	
			5 yrs	8 yrs	5 yrs	8 yrs	GU	GI
Zamboglou/ retrospective	718	53 months	94	90	98	97	3.5	1.6

Desenlaces: RTE + HDR

# of Series	N	Follow-up	PSA DFS by Risk Group		
			Low	Intermediate	High
12	2054	71 (61-105) months	92-100%	83-100%	57-97%

Khor, Cury, Prada, Kotecha, Kaprealian, Savdie, Aluwini, Agoston, Morton, Pellizzon, Ghadjar, Zwahlen

Table 3. Summary of studies showing freedom from biochemical relapse after high dose rate (HDR) brachytherapy combined with external beam radiotherapy (EBRT), according to risk group

Reference	Dose schedule	No. of patients	Low risk (%)	Intermediate risk (%)	High risk (%)	End point (years)
Aström et al [34]	EBRT: 50 Gy @ 2 Gy per fraction HDR: 2×10 Gy per fraction	214	100	100	86	4
Flynn et al [38]	NAHT: 86% EBRT: 45 Gy @ 1.8 Gy per fraction HDR: 15.5–21.0 Gy in 3 or 4 fractions	674	97	92	72	5
Galalae et al [33]	EBRT: 45.6–50.0 Gy @ 1.8–2.0 Gy per fraction HDR: BED 79.6–123.0 Gy	611	96	88	69	5
Galalae et al [39]	NAHT: 0% BED: <94 Gy *vs* >94 Gy	324	–	85	81	5
Guix et al [41]	EBRT: 46–66 Gy @ 2 Gy per fraction HDR: 2×5–8 Gy	445	–	95	94	5
Izard et al [43]	NAHT: median 6 months EBRT: 45.0–59.4 Gy @ 1.8 Gy per fraction PDR BRT: 18 Gy in 3 fractions	165	100	95	67	5
Martinez et al [44]	NAHT: no HDR: 5.5–11.5 Gy per fraction	207	–	85	75	5
Phan et al [46]	NAHT: 36% EBRT: 36.0–50.4 @ 1.8–2.0 Gy per fraction HDR: 22–24 Gy	309	100	100	97	5
Yamada et al [47]	EBRT: 45.0–50.4 Gy @ 1.8 Gy per fraction HDR: 5.5–7.0 Gy in single fraction	105	100	98	92	5
Pellizzon et al [45]	EBRT: 45 Gy median HDR: 20 Gy median	209	91	90	89	5
Agoston et al [36]	EBRT: 60 Gy median HDR: 10 Gy in single fraction	280	–	84	82	5
Demanes et al [37]	NAHT: no EBRT: 36 Gy @ 1.8 Gy per fraction HDR: 22–24 Gy in 4 fractions	209	93	82	62	10
Ghilezan et al [40]	NAHT: 43% EBRT: 40 Gy median HDR: 24 Gy median	1577	–	88	74	10
Hasan et al [42]		886	98	92	71	10

BED, biologically equivalent dose; NAHT, neoadjuvant hormone therapy; PDR, pulse dose rate brachytherapy.

Author	N	Median; follow-up (months)	Late grade 3 toxicity		bDFS by risk group			Dose/fraction (EBRT + HDR) in Gy
			GU	GI	Low	Intermediate	High	
Agoston [25]	100	62	14%	2%		84%	82%	60/30 + 10/1
Aluwini [26]	264	75	4%	1%	97%			45/25 + 18/3
Bachand [27]	153	44				96%		44/22 + 18/2-20/2
Cury [28]	121	63	2%	2%		91%		50/20 + 10/1
Deutsch [29]	160	53			100%	98%	93%	50.4/28 + 21/3
Galalae [30]	122	117	5%	3%	88%	71%	72%	50/25 + 18-30 Gy*/2
Ghadjar [31]	64	61	14%	0%		100%	91%	50/25 + 21/3
Kaprealian [32]	64 101	105 43	1%	0%		84% 94%	80% 82%	45/25 + 18/3 45/25 + 19/2
Khor [33]	344	61	2%	0%		84%	74%	46/23 + 19.5/3
Kotecha [34]	229	61	5%	0.4%	95%	90%	57%	50.4/28 + 16.5-22.5/3
Lilleby [35]	275	44				100%	98.8%	50/25 + 20/2
Marina [36]	282	96				91%		46/23 + 19-23 Gy/2
Martínez-Monge [37]	200	44	5%	2%			85%	54/27 + 19/4
	60 123	72 45	4% 1%	0% 0%		98% 95%		45/25 + 2 37.5/15 +
Neviani [39]	455	48	8%	1%	92%	88%	85%	45/25 + 16.5/3-21/3
Pellizon [40]	209	64			92%	90%	89%	45/25 + 20/2
Phan [41]	309	59	4%	0.3%	98%	90%	78%	36/18-50.4/28 + 15/3-26/4
Pistis [42]	114	32					97%	60/30 + 10/1
Prada [43]	313	68	2%	0%	100%	88%	79-91%	46/23 + 23/2
Savdie [44]	90	95					80%	45/25 + 16.5/3
Whalley [45]	101	56	2%	0%		95%	66%	46/23 + 19.5/3-17/2
Zwahlen [46]	196	66	7%	0%		83%		46/23 + 20/4-18/3

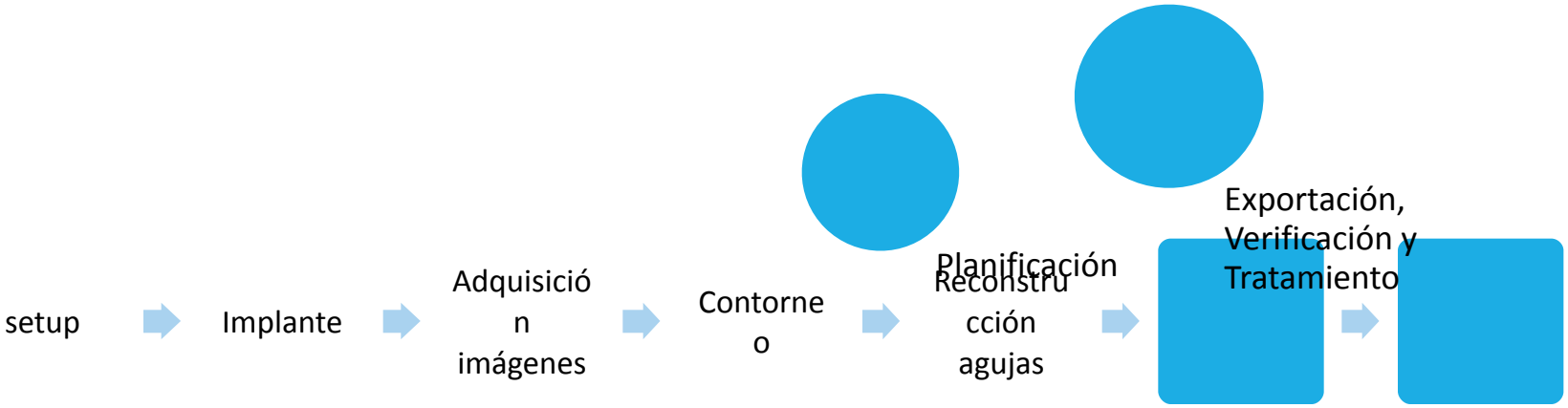
Yamada et al. American Brachytherapy Society consensus guidelines for high-dose-rate prostate brachytherapy. Brachytherapy 2012; 11: 20-32

Current dose fractionation schedules

Institution	Dose Fractionation	Bladder	Urethra	Rectum
MSKCC	Boost 7 Gy x 3 Mono 9.5 Gy x 4 Salvage 8 Gy x 4		< 120% prescription	$D2_{cc}$<70%
UCSF	Boost 15 Gy x 1 Mono 10.5 Gy x 3 Salvage 8 Gy x 4*	V_{75}<1 cc	V_{125}<1 cc, V_{150} = 0 cc *(dose tunnel whenever possible)	V_{75}<1 cc
WBH	Boost 10.5 Gy x 2 Mono 4 x 9.5 Gy (historical) 12-13.5 Gy x 2 (current) Salvage 7 Gy x 4 combined with hyperthermia	No constraint (intra-op TRUS-based dosi)	V_{100} < 90% of prescription V_{115} < 1% of prescription	V_{75} < 1% of prescription
TCC	Boost 6 Gy x 2 2 implants	< 80% of Rx	< 125% of prescription	< 80% of Rx to outer wall
GW	Boost 6.5 Gy x 3 Mono two sessions of 6.5 Gy x 3	< 100% prescription	< 110% prescription	mucosa < 60%, outer wall < 100%
Toronto	Boost 15 Gy x 1	n/a	D_{10} < 118% Max < 125%	V80 < 0.5 cc
UCLA-CET	Boost 6 Gy x 4 Mono 7.25 Gy x 6	90 - 100% wall 80% balloon	120% combo 105% any TUR 110% mono	Rectal wall 80% Rectal wall 80 - 85%

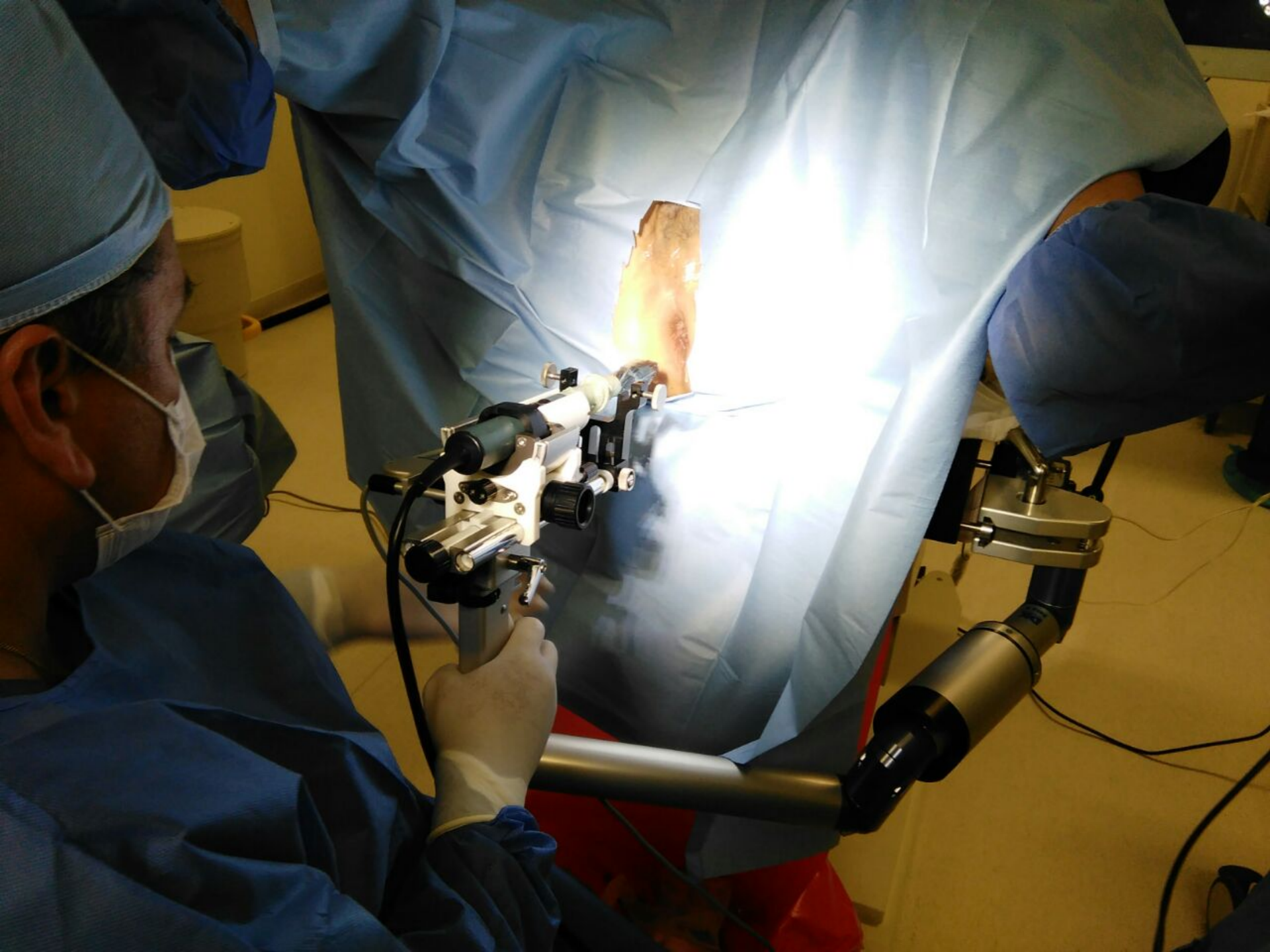
MSKCC5Memorial Sloan-Kettering Cancer Center; UCSF5University of California San Francisco;WBH5William Beaumont Hospital; TCC5Texas Cancer Center;GW5GammaWest Brachytherapy; Toronto5University of Toronto; UCLA-CET5University of California Los Angeles-California Endocurietherapy Cancer Center; V805fractional volume covered by 80% of the prescription dose; V1005fractional volume covered by 100% of the prescription dose; V1155fractional volume covered by 100% of the prescription dose; V1255fractional volume covered by 125% of the prescription dose; V1505fractional volume covered by 150% of the prescription dose; D105dose that covers the highest 10% of the organ; Rx5prescription; TUR5transurethral resection

Flujograma bien establecido




bk medical


Dräger
Primus



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]

Abstract

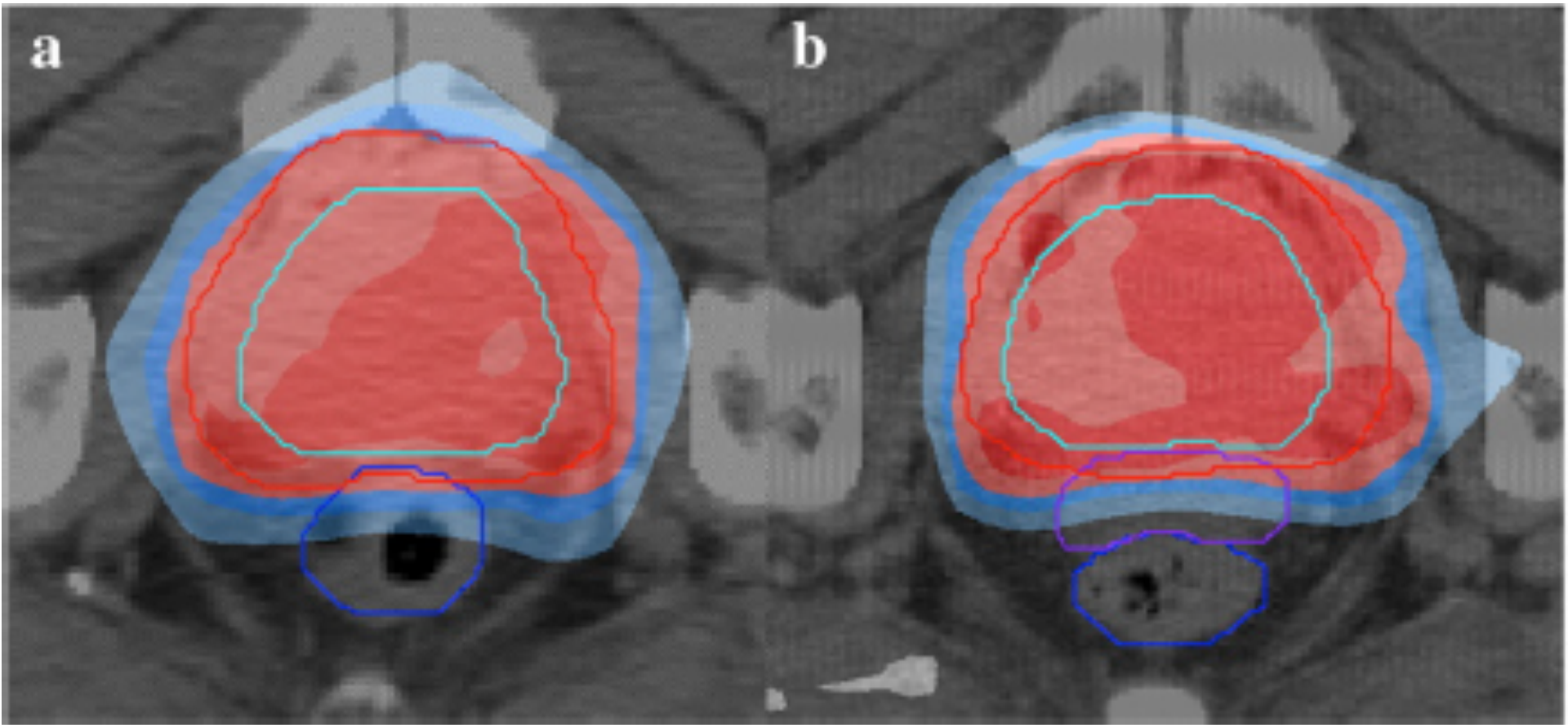
Background: Radiation therapy is one of the recommended treatment options for localized prostate cancer. In randomized trials, dose escalation was correlated with better biochemical control but also with higher rectal toxicity. A prospective multicenter phase II study was carried out to evaluate the safety, clinical and dosimetric effects of the hydrogel prostate-rectum spacer. Here we present the 12 months toxicity results of this trial.

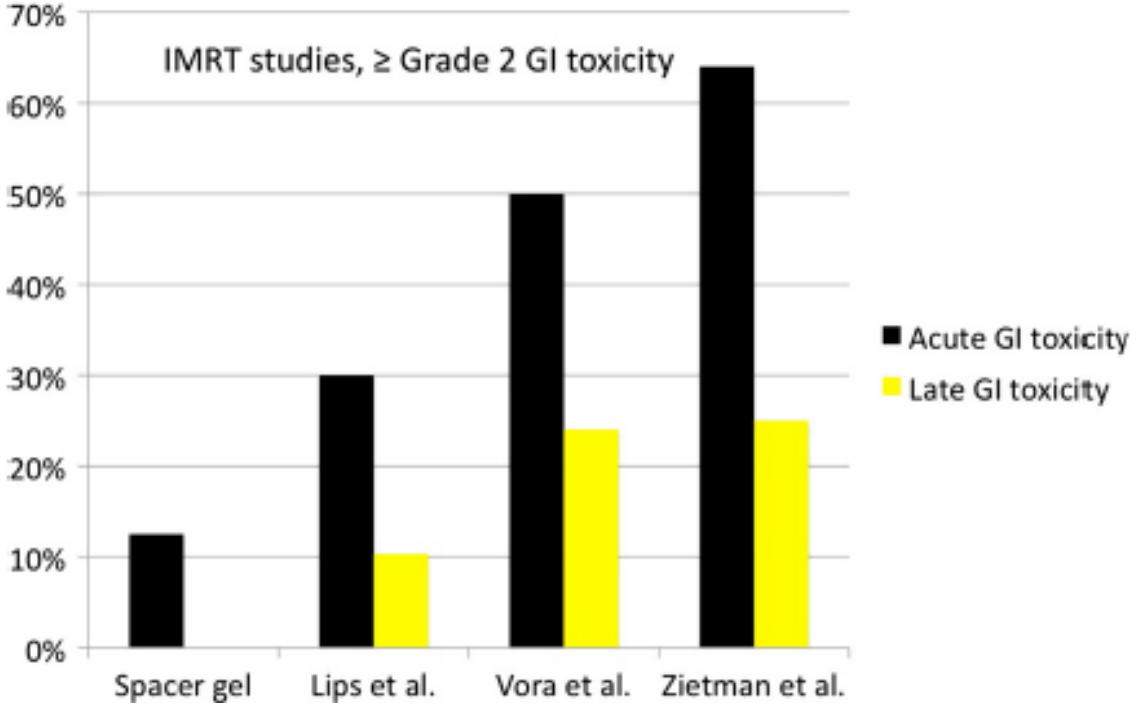
Methods: Fifty two patients with localized prostate cancer received a transperineal PEG hydrogel injection between the prostate and rectum, and then received IMRT to a dose of 78 Gy. Gastrointestinal and genitourinary toxicity were recorded during treatment and at 3, 6 and 12 months following irradiation by using the RTOG/EORTC criteria. Additionally, proctoscopy was performed 12 months after treatment and the results were scored using the Vienna Rectoscopy Scale (VRS).

Results: Of the patients treated 39.6% and 12.5% experienced acute Grade 1 and Grade 2 GI toxicity, respectively. There was no Grade 3 or Grade 4 acute GI toxicity experienced in the study. Only 4.3% showed late Grade 1 GI toxicity, and there was no late Grade 2 or greater GI toxicity experienced in the study. A total of 41.7%, 35.4% and 2.1% of the men experienced acute Grade 1, Grade 2 and Grade 3 GU toxicity, respectively. There was no Grade 4 acute GU toxicity experienced in the study. Late Grade 1 and Grade 2 GU toxicity was experienced in 17.0% and 2.1% of the patients, respectively. There was no late Grade 3 or greater GU toxicity experienced in the study. Seventy one percent of the patients had a VRS score of 0, and one patient (2%) had Grade 3 teleangiectasia. There was no evidence of ulceration, stricture or necrosis at 12 months.

Conclusion: The use of PEG spacer gel is a safe and effective method to spare the rectum from higher dose and toxicity.

Keywords: Prostate cancer, Radiotherapy, Rectal toxicity, Hydrogel, Spacer, IMRT


a
b



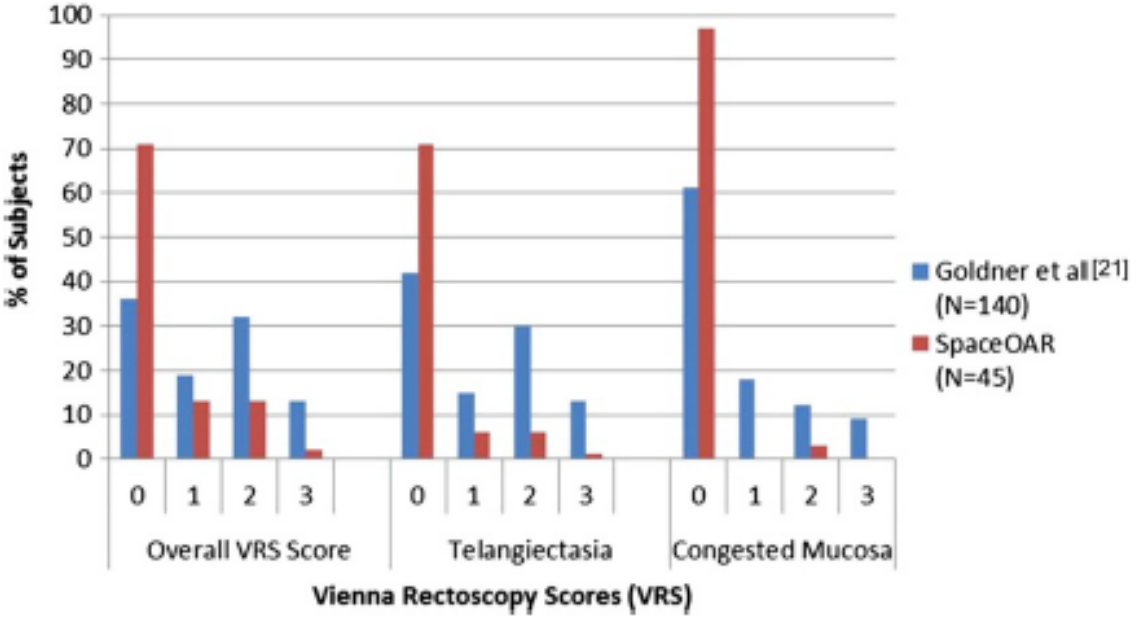
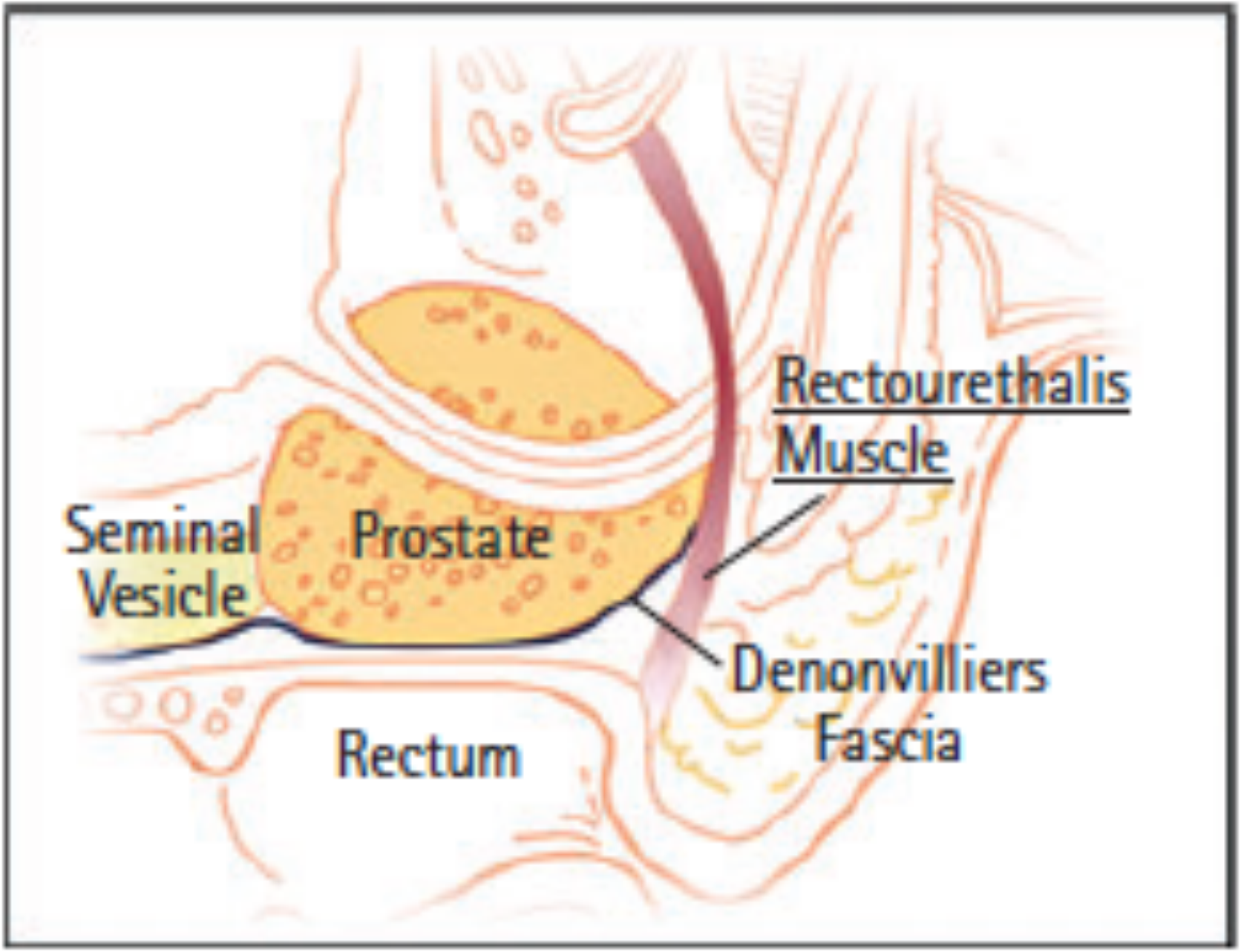
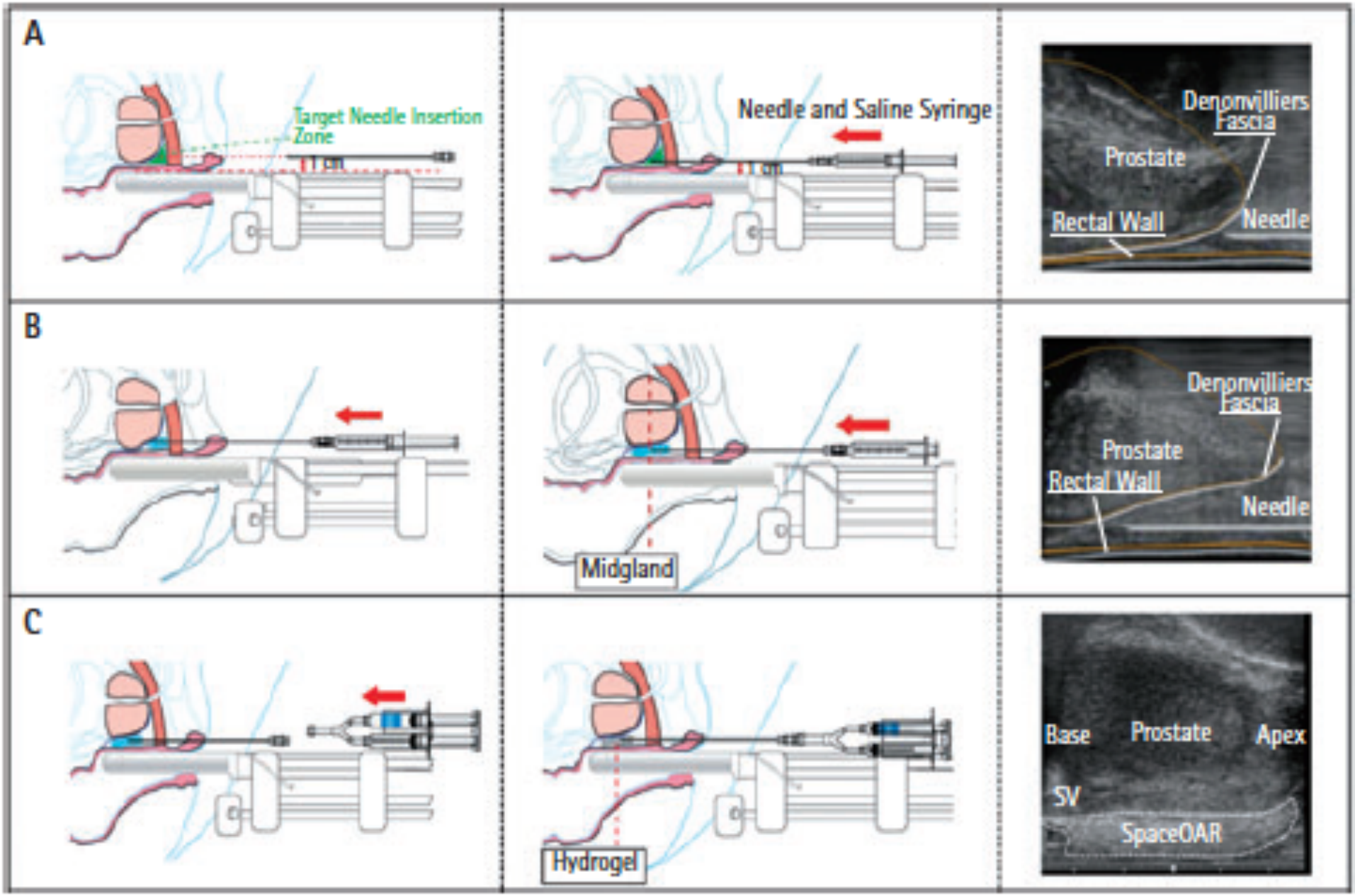


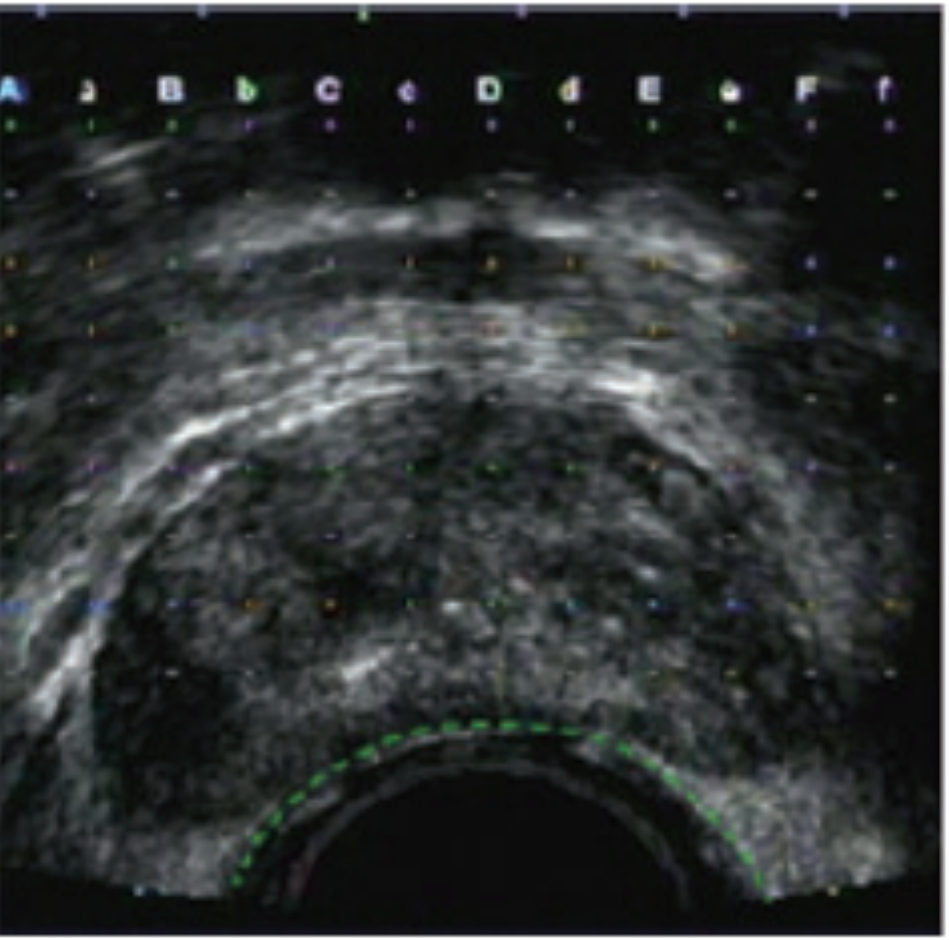
Figure 3 Comparison of Vienna rectoscopy scores at 12 months for men treated with SpaceOAR vs. the literature [21].

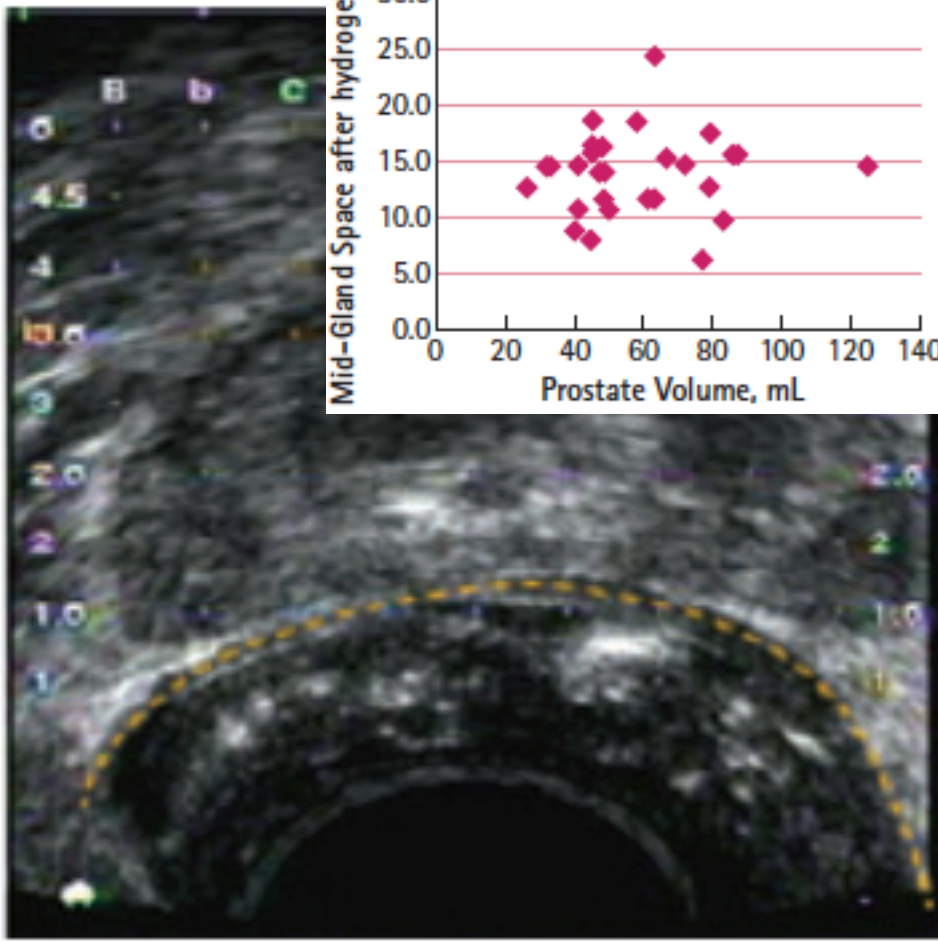


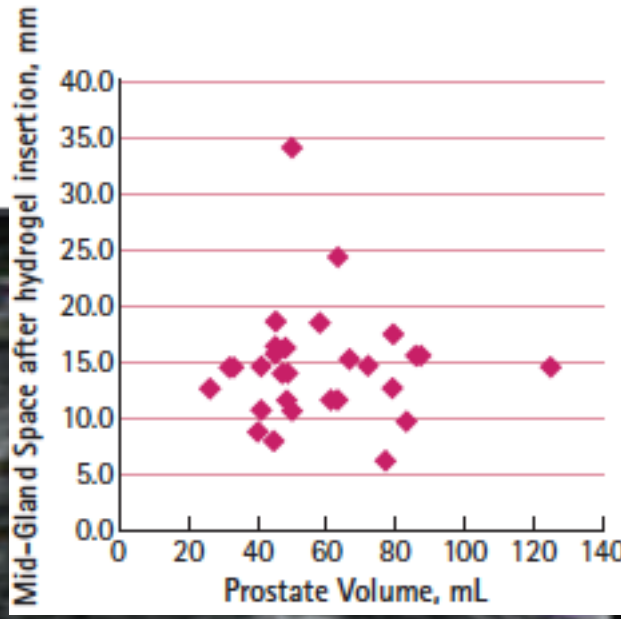
Application technique: placement of a prostate – rectum spacer in men undergoing prostate radiation therapy. doi:10.1111/j.1464-410X.2012.11373.x



Application technique: placement of a prostate – rectum spacer in men undergoing prostate radiation therapy. doi:10.1111/j.1464-410X.2012.11373.x






Mid-Gland Space after hydrogel insertion, mm
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
140
Prostate Volume, mL

The Use of an Injectable Spacer Material in Conjunction With High Dose-Rate Brachytherapy for Prostate Cancer

Kenneth M. Tokita, MD, Lucy Chittenden, BS, Albert Mesa, MS, Jessica Lane, Emi Kibuishi, Judith Harrison, MD, Ron Gilbert, MD, Greg Barme, MD, Luis Kobashi, MD, Aaron Spitz, MD, John Ravera, MD. Radiation Oncology, Cancer Center of Irvine, Irvine, CA.

Purpose:

To evaluate the use of an injectable spacer material for high-doserate (HDR) brachytherapy for prostate cancer.

Materials and Methods:

Between January and August 2010, 24 HDR brachytherapy implants were performed at the Cancer Center of Irvine. The implants were part of an overall radiotherapy course consisting of HDR brachytherapy combined with intensity modulated radiation therapy. The HDR was administered via two implants separated by one week. In order to increase the distance between the prostate and rectum, the patients were administered a spacing material in the prostate rectal interspace. The spacer was administered transperineally at the time of catheter implantation. Each patient was imaged pre implantation, post implantation, and every two weeks until the end of the treatment course. The 3D image datasets were used to determine the spacer distribution from the prostate base to apex, and 3D HDR brachytherapy treatment plans were analyzed to quantify rectal dose sparing. Results: 3D image analysis shows the injection of a spacer material increases the mean prostate rectal spacing by 0.9cm, 0.8cm and 0.8cm at the base, middle and apex of the gland. Dose volume histogram analysis reveals an average decrease in rectal V70 and V50 from 41.4% and 54% to 33.6% and 42.3%, respectively, with the use of the spacer material. In addition, the maximum rectal dose fell 36.6% due to the increase in prostate rectal spacing.

Conclusions:

Since the primary benefits of HDR prostate brachytherapy are dose localization and normal tissue sparing, it is important to minimize the dose to the rectum.We have demonstrated that spacing on the order of 0.8 e 0.9 cm is achievable with the use of an injectable tissue spacer. This enhanced spacing provides significant dosimetric advantages. In this study we have demonstrated that the injection of a tissue spacer is feasible, quantifiable and a viable means to enhance rectal dose sparing

2363 Use of a Blood-patch Technique to Reduce Rectal Dose during Cesium-131 Prostate Brachytherapy

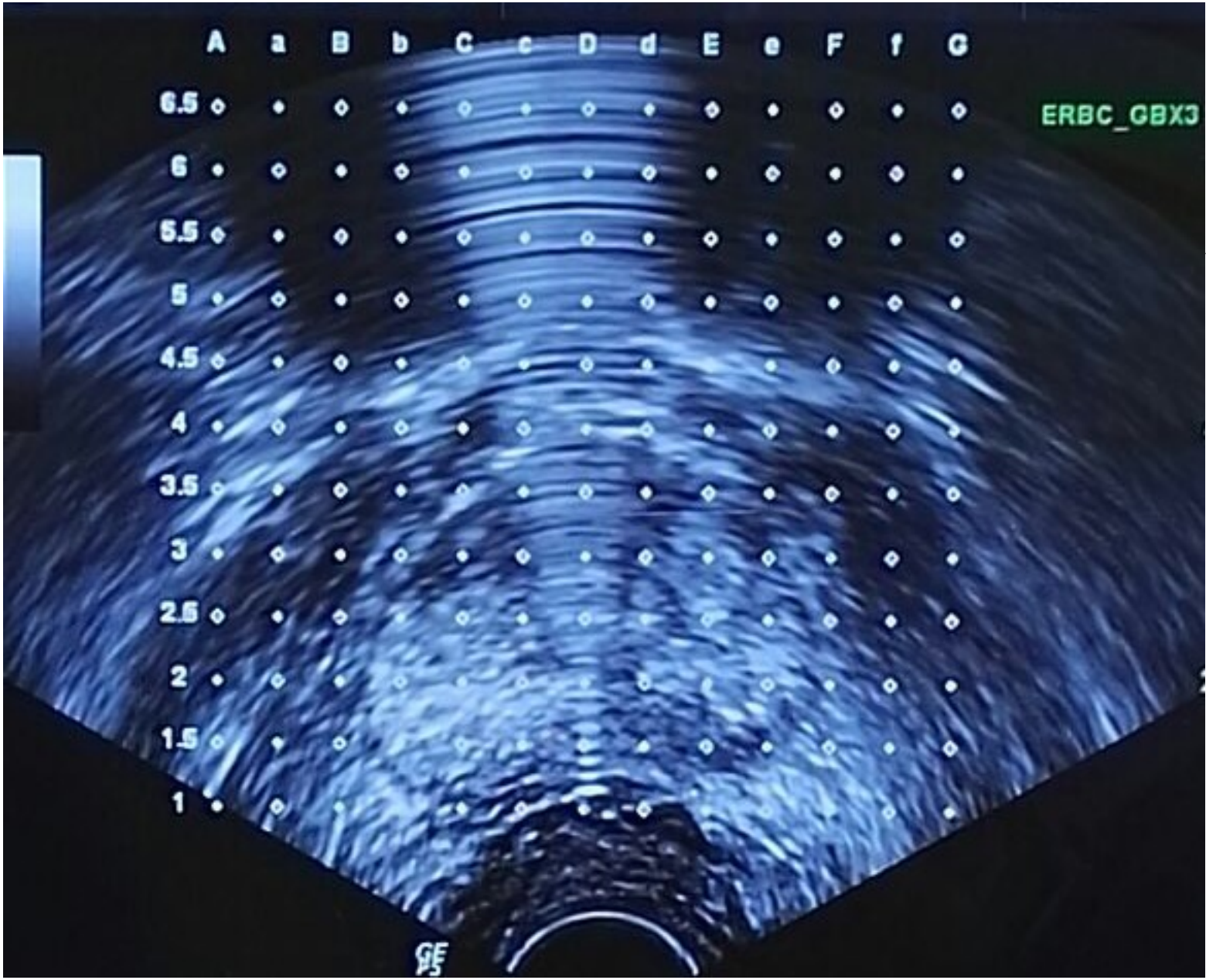
T. J. Morancy[1], K. M. Winkfield[2], C. A. Karasiewicz[1], I. D. Kaplan[1], [1]*Department of Radiation Oncology, Beth Israel Deaconess Medical Center, Boston, MA,* [2]*Harvard Radiation Oncology Program, Harvard Medical School, Boston, MA*

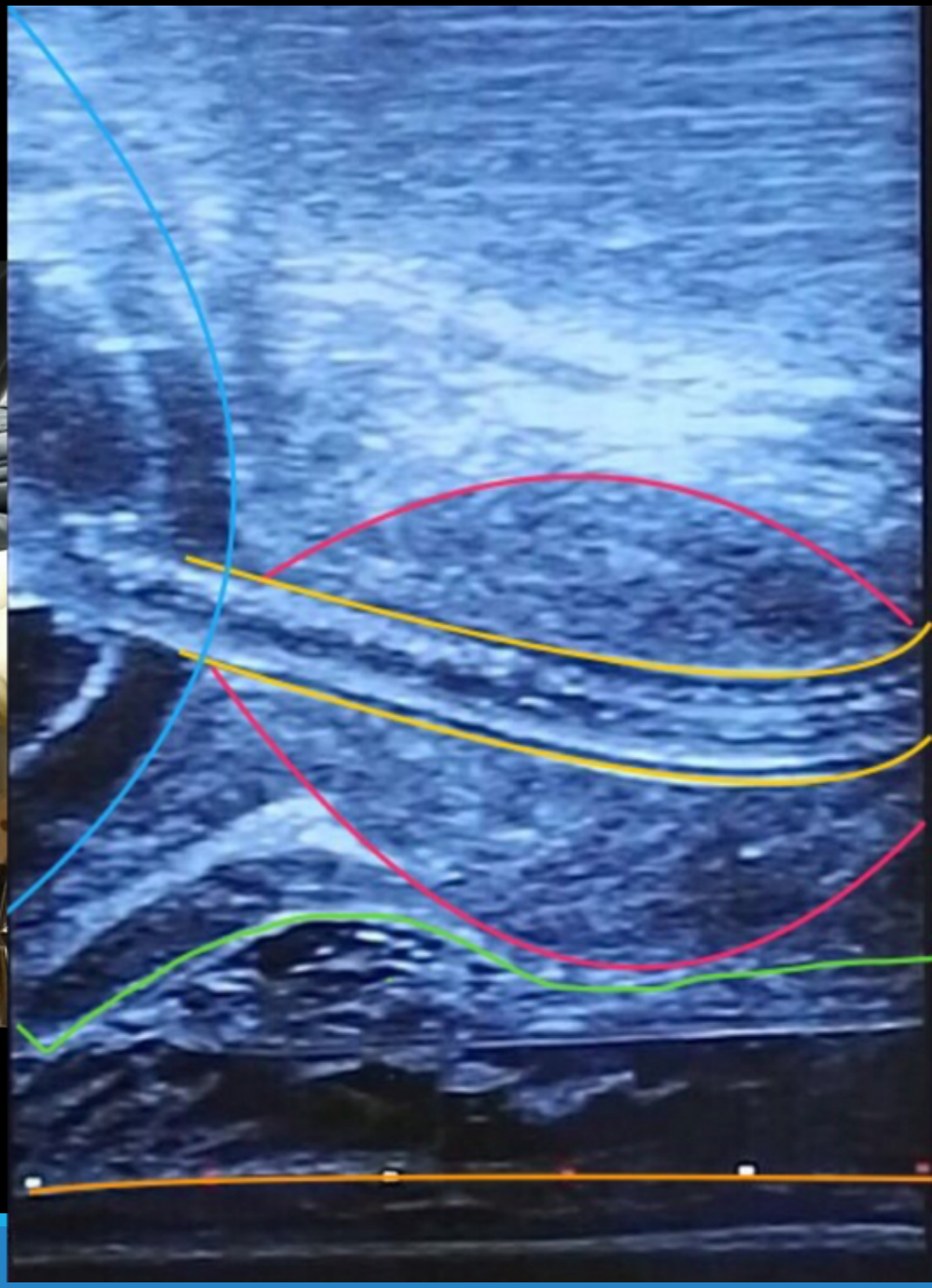
Purpose/Objective(s): To introduce a novel technique for decreasing rectal dose during Cesium-131 prostate brachytherapy.

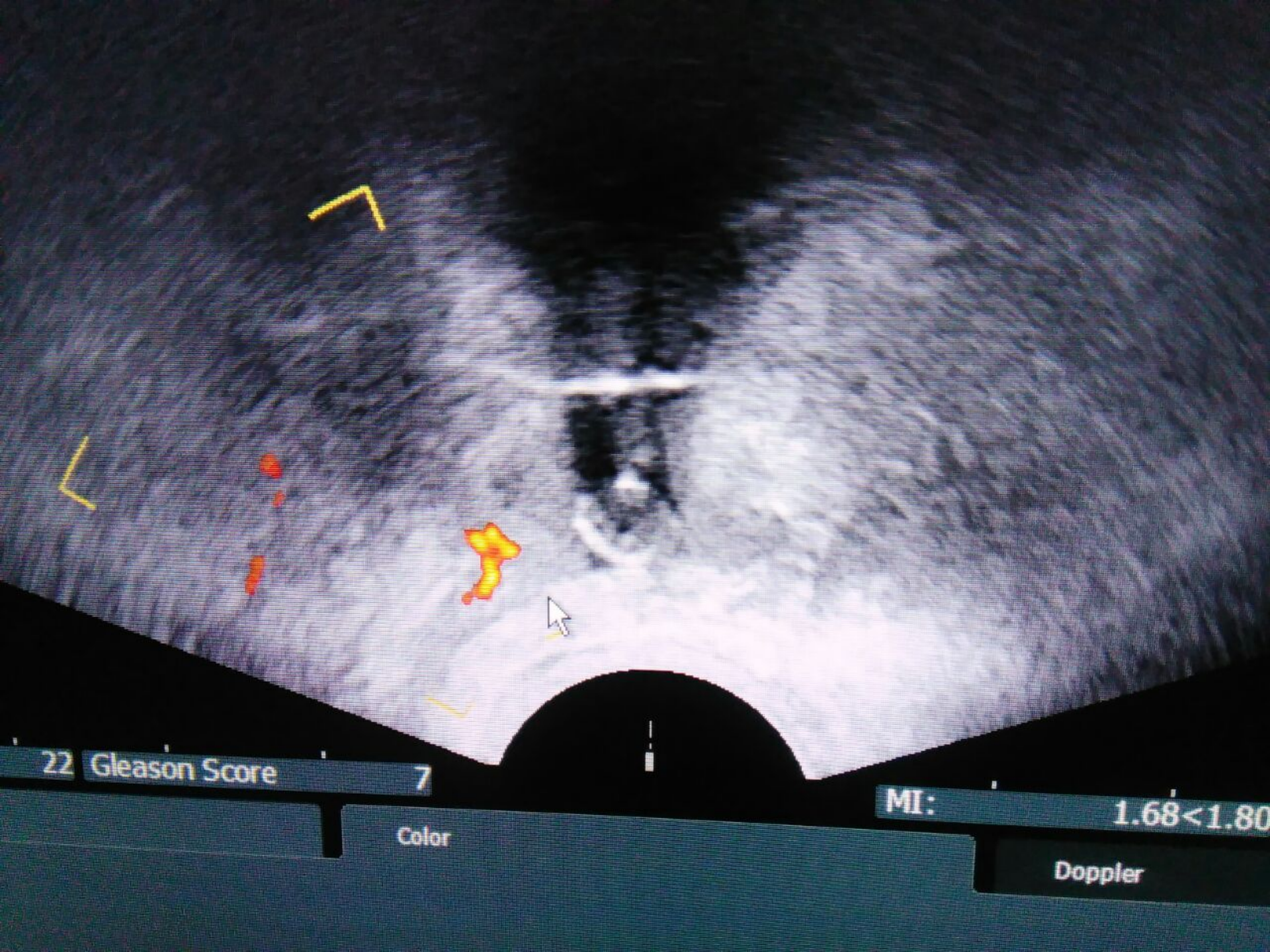
Materials/Methods: Three patients underwent prostate brachytherapy seed implantation using Cesium-131 seeds. Following induction of general anesthesia, the patient was placed in the dorsal lithotomy position. A transrectal ultrasound probe was inserted into the rectum, and an initial set of sequential images was obtained at 0.5 cm throughout the prostate. Within the treatment planning platform, the prostate, rectum, and urethra were contoured to determine relative positions, estimate the "pre-patch" volumes, and ascertain the amount of peri-rectal fat. Approximately 20 mL of blood was removed from the patient via antecubital venipuncture. The perineum was prepped for sterile procedure. Under ultrasound guidance, a biopsy needle was placed within the tissue plane between the prostate and rectum on each side of the gland in turn. Half the volume of blood was then instilled within the peri-rectal space as the needle was withdrawn, using the sagittal ultrasound image for guidance. After creation of the blood patch, a second set of sequential images was obtained, and contours drawn as indicated above. The post-patch contour set was used to develop an intra-operative brachytherapy seed implantation plan, with a target dose of 100 Gy. The seeds were implanted under ultrasound and fluoroscopic guidance. Following completion of the procedure, the change in the anterior peri-rectal space was determined by comparing the pre- and post-patch contours. The dose plan was held constant by superimposing the post-patch plan over the pre-patch contours. Needle positions were shifted posteriorly based on the change in peri-rectal space.

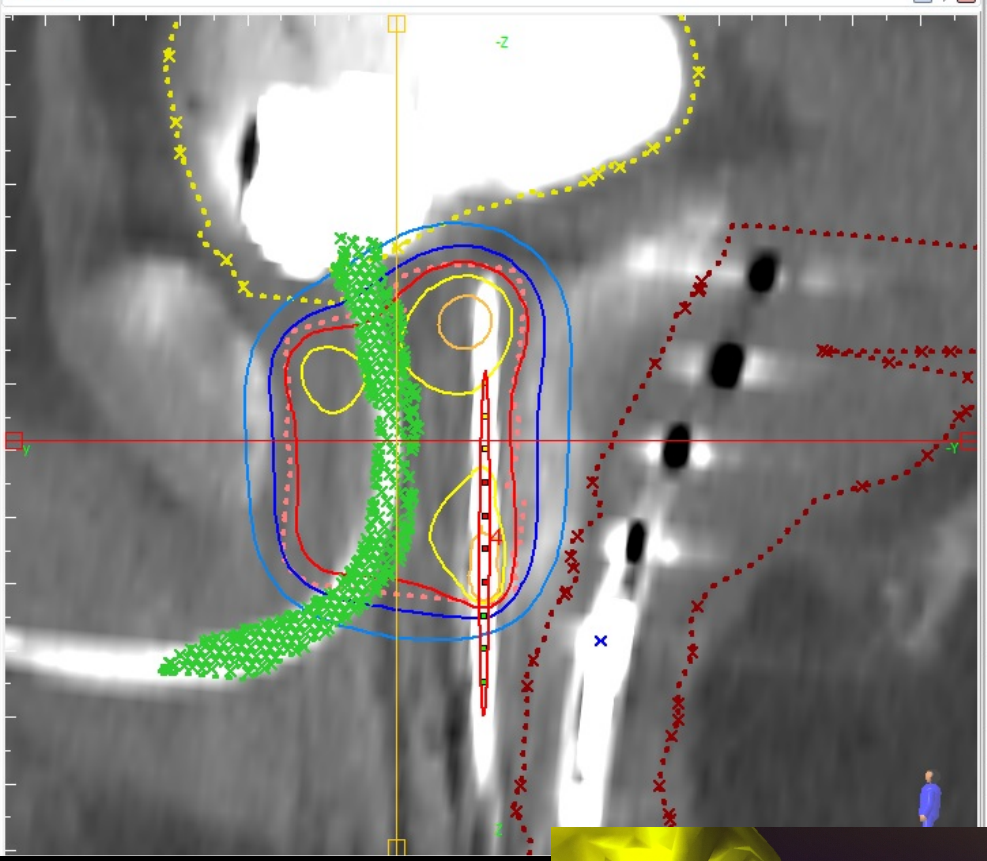
Results: A blood patch was successfully applied in all three patients. Comparison of pre- and post-patch volumes show an average of 3.86 mm increase in the anterior peri-rectal space following creation of the blood patch. DVHs confirm decreased rectal dose after application of the patch: rectal D_{100} decreased from 15 Gy to 10.5 Gy and V_{100} decreased from 3.44 cc to 0 cc. Ultrasound imaging obtained 1 week after brachytherapy shows the blood patch still in place.

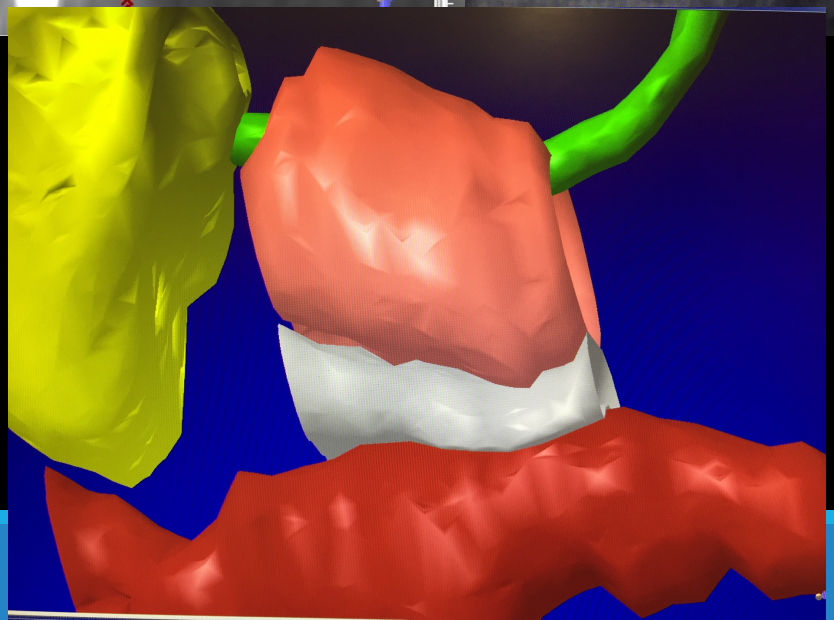
Conclusions: Use of a blood patch reduces the dose of radiation to the rectum and may help decrease the amount of late rectal complications from prostate seed implantation with Cesium-131. This technique could be particularly beneficial in patients with minimal peri-rectal fat.

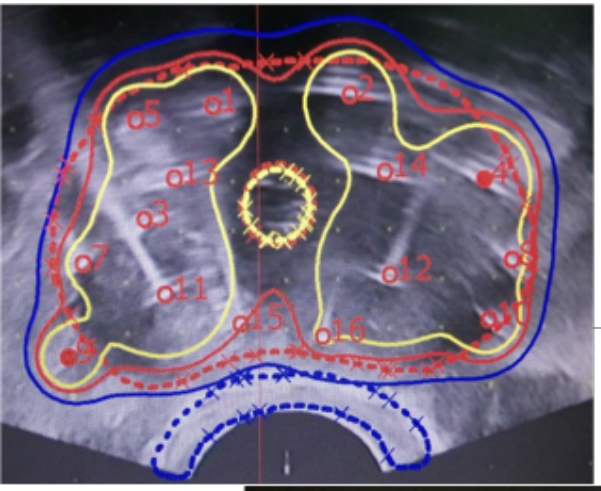

A a B b C c D d E e F f G
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
ERBC_GBX3
GE

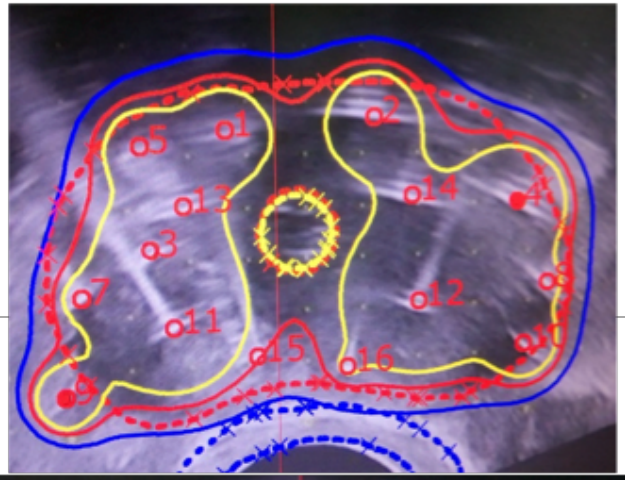


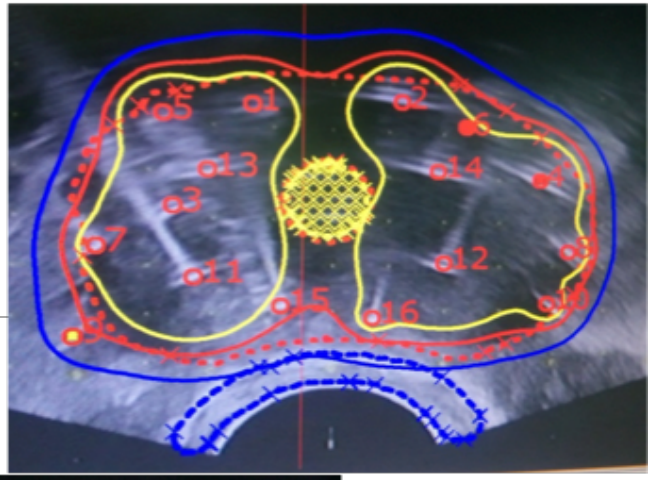

22 Gleason Score 7
Color
MI: 1.68<1.80
Doppler

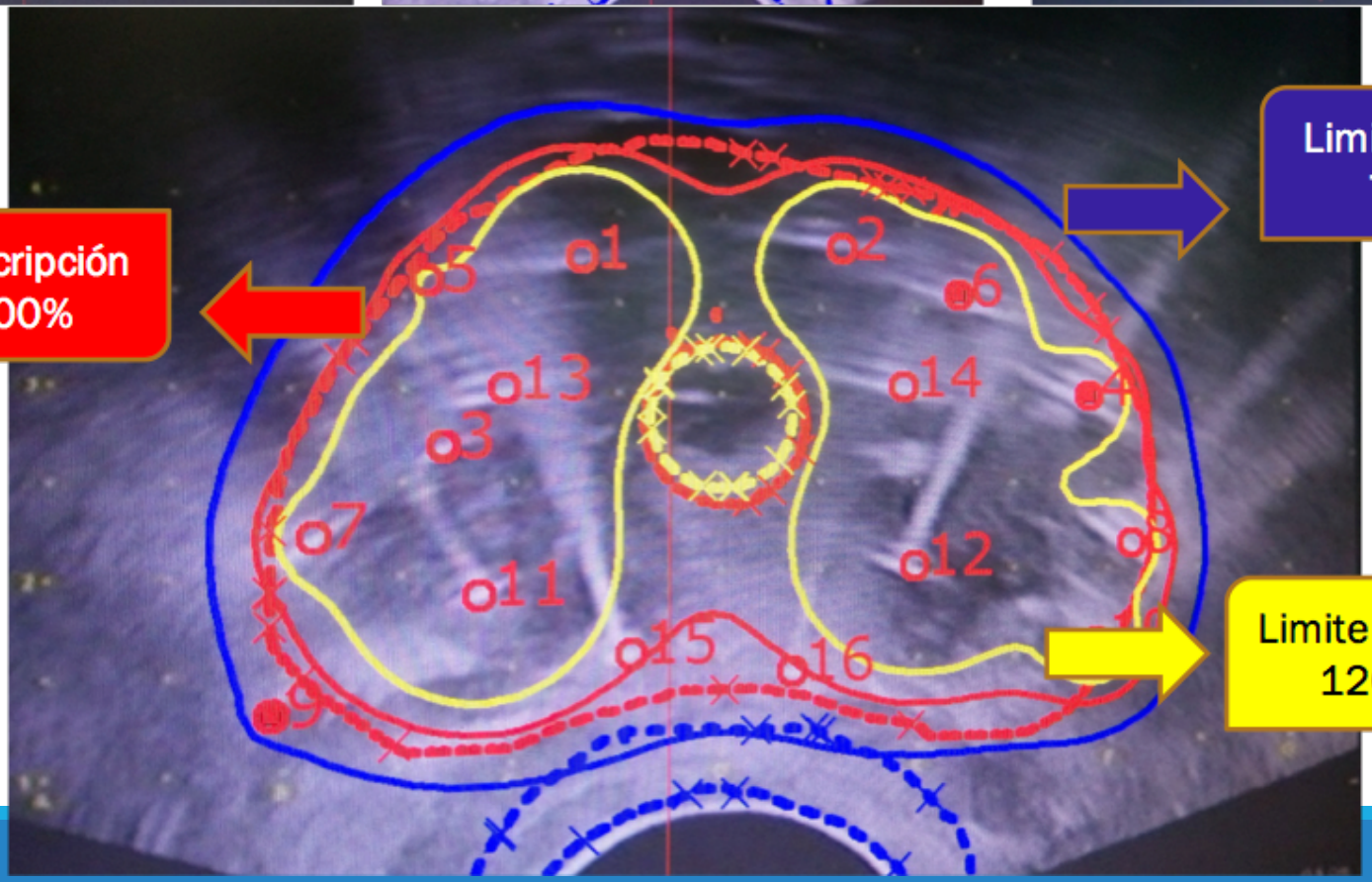


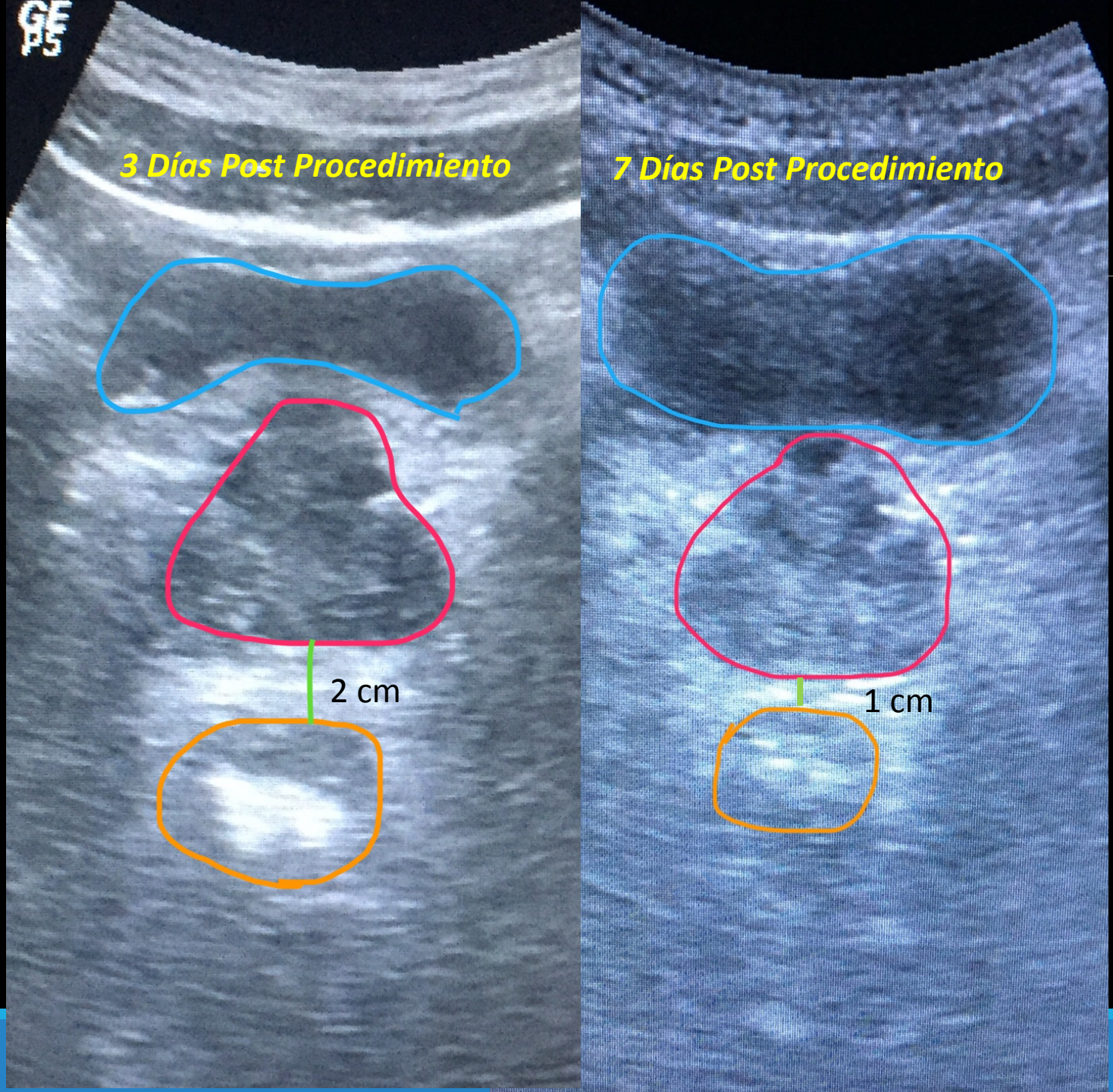




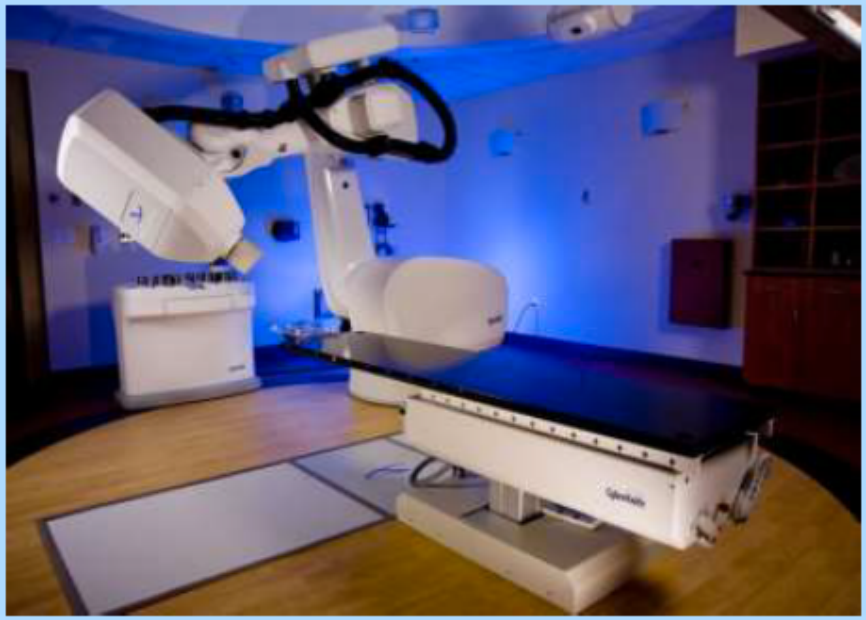


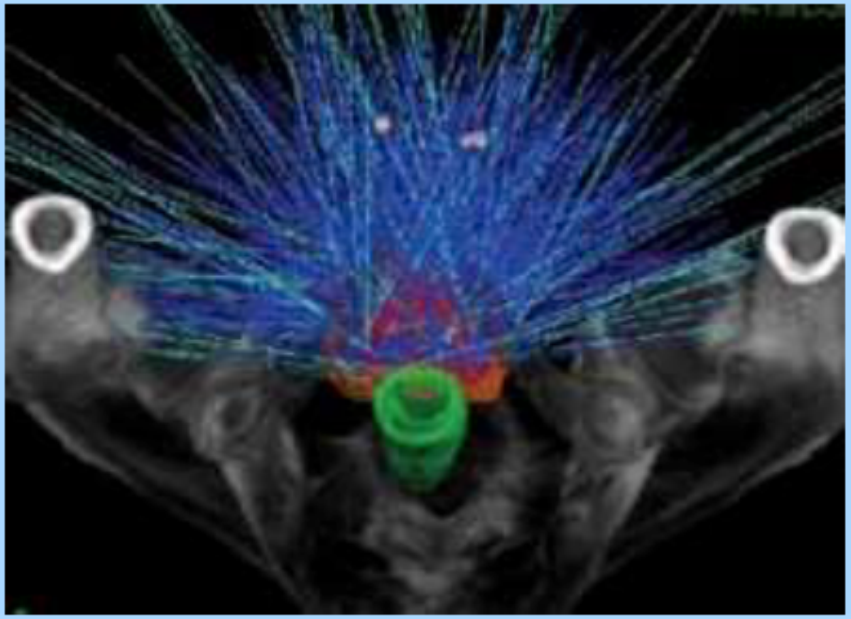



Prescripción
100%
Limite recto
70%
Limite uretra
120%

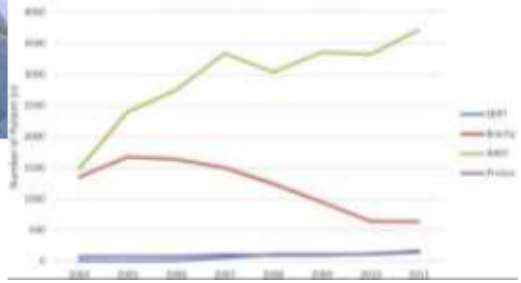

3 Días Post Procedimiento
2 cm
7 Días Post Procedimiento
1 cm

SBRT IS SEXY





It's Time to Make Brachytherapy Sexy Again



Real problem!

Radical prostatectomy

Nerve sparing prostatectomy

Laparoscopic prostatectomy Robotic surgery

or

Conventional external beam

3-D

IMRT

Proton

Conformal external beam

IGRT

High-dose conformal

Dose escalation

High dose rate

Brachytherapy

Hypofractionation

Low dose rate

Brachytherapy/external beam

HIFU

RITA

Cryotherapy

Any of the above with androgen deprivation

Radiation oncologist

What my friends think I do.

What my family thinks I do.

What society thinks I do.

What other medical specialties think I do.

What I think I do.

What I actually do.

@TiagoRamos


Oncosalud
auna


BRAQUITERAPIA


Gracias!