Pro und Contra Diskussion: Brachytherapie vs. SBRT

PD Dr. Simon Spohn
Oberarzt
Klinik für Strahlenheilkunde
Universitätsklinikum Freiburg

Stereotaxie Symposium 06/07.02.2026 Graz

Focal Boost to the Intraprostatic Tumor in External Beam Radiotherapy for Patients With Localized Prostate Canc 10-Year Outcomes of the FLAME Trial

Karolína Menne Guricová, MSc[1]; Cédric Draulans, MD, PhD[2]; Floris J. Pos, MD, PhD[1]; Linda G.W. Kerkmeijer, MD, PhD[3,4]; Evelyn M. Monninkhof, PhD[5]; Robert J. Smeenk, MD, PhD[3]; Martina Kunze-Busch, PhD[3]; Hans C.J. de Boer, PhD[4] Jochem R.N. van der Voort van der Zyp, MD, PhD[4]; Karin Haustermans, MD, PhD[2,6]; and Uulke A. van der Heide,

DOI https://doi.org/10.1200/JCO-25-00274

JOURNAL OF CLINICAL ONCOLOGY ORIGINAL REPORT

Conventional versus hypofractionated high-dose intensity-modulated radiotherapy for prostate cancer: 5-year outcomes of the randomised, non-inferiority, pha CHHiP trial

David Dearnaley, Isabel Syndikus, Helen Mossop, Vincent Khoo, Alison Birtle, David Bloomfield, John Graham, Peter Kirkbride, John Logue Zafar Malik, Julian Money-Kyrle, Joe M O'Sullivan, Miguel Panades, Chris Parker, Helen Patterson*, Christopher Scrase, John Staffurth, Andrew Stockdale, Jean Tremlett, Margaret Bidmead, Helen Mayles, Olivia Naismith, Chris South, Annie Gao, Clare Cruickshank, Shama I Julia Pugh, Clare Griffin, Emma Hall, on behalf of the CHHiP Investigators

available at www.sciencedirect.com
journal homepage: www.europeanurology.com

European Association of Urology

EUROPEAN UROLOGY

ion Regimen

W.M. Chung, Glenn S. S. Wu, Matthew B. de, Tim K. Craig, Jim A.

Brief Report

Magnetic Resonance Imaging Versus Computed Tomography Guidance for Stereotactic Body Radiotherapy in Prostate Cancer: 2-year Outcomes from the MIRAGE Randomized Clinical Trial

Ultra-hypofractionated versus conventionally radiotherapy for prostate cancer: 5-year outcor HYPO-RT-PC randomised, non-inferiority, phas

Anders Widmark, Adalsteinn Gunnlaugsson, Lars Beckman, Camilla Thellenberg-Karlsson, Morten Hoyer, Magnu Claes Ginman, Bengt Johansson, Kirsten Björnlinger, Mihajl Seke, Måns Agrup, Per Fransson, Björn Tavelin, Davic Harald Anderson, Elisabeth Kjellén, Lars Franzén, Per Nilsson

original reports

Prostate-Only Versus Whole-Pelvic Radiation Therapy in High-Risk and Very High-Risk Prostate Cancer (POP-RT): Outcomes From Phase III Randomized Controlled Trial

Vedang Murthy, MD[1]; Priyamvada Maitre, MD[1]; Sadhana Kannan, MSc[2]; Gitanjali Panigrahi, MSc[1]; Rahul Krishnatry, MD[1]; Ganesh Bakshi, MCh[3]; Gagan Prakash, DNB[3]; Mahendra Pal, DNB[3]; Santosh Menon, MD[4]; Reena Phurailatpam, MSc[5]; Smruti Mokal, MSc[2]; Dipika Chaurasiya, BSc[1]; Palak Popat, DNB[6]; Nilesh Sable, MD[6]; Archi Agarwal, DNB[7]; Venkatesh Rangarajan, DNB[7]; Amit Joshi, DM[8]; Vanita Noronha, DM[8]; Kumar Prabhash, DM[8]; and Umesh Mahantshetty, MD[1]

SBRT Studien

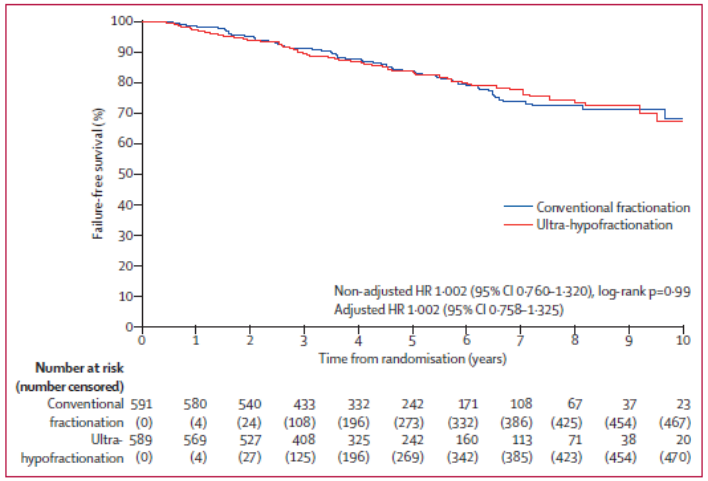
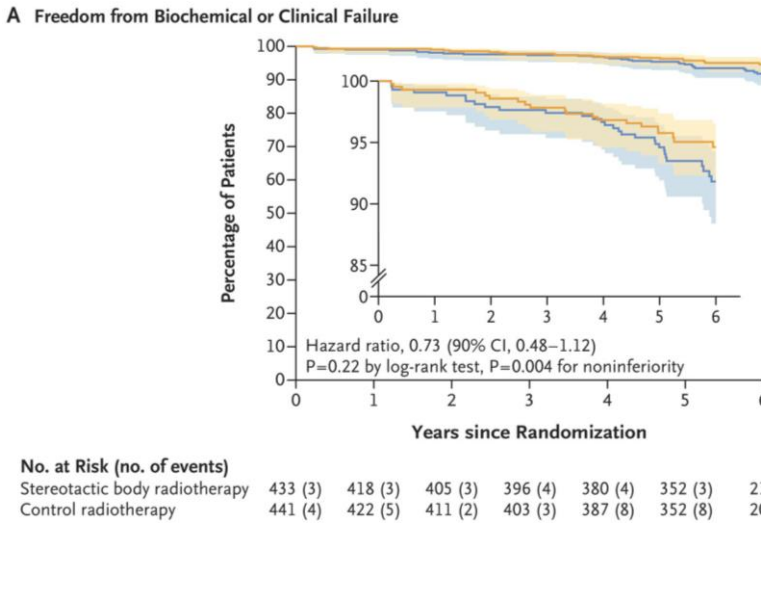
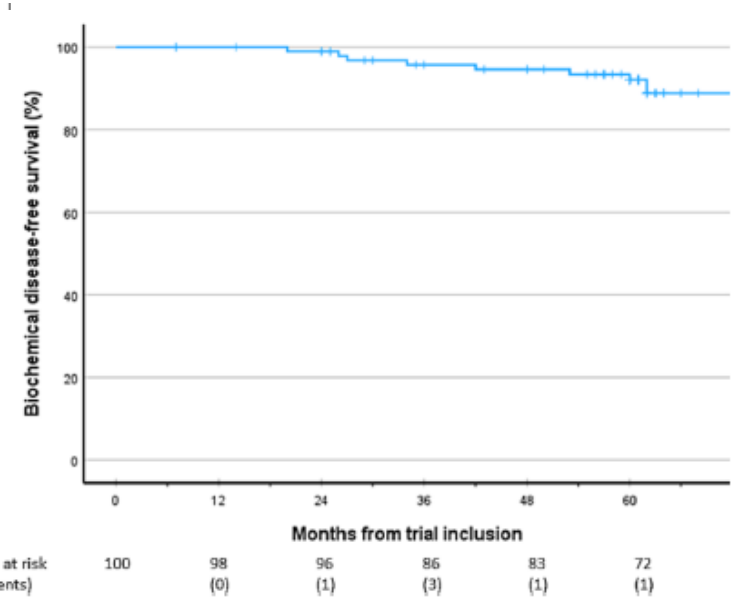


Figure 2: Failure-free survival
HR=hazard ratio.





HYPO-RT
Phase III
Intermediate- and high risk (ca. 10%)
CFRT:
78 Gy in 39 Fraktionenvs SBRT:
42.7 Gy in 7 Fraktionen
N=1200 Patienten

PACE-B:
Phase III
62/3,1 and 78/2 Gy
vs 36,25/7,25 Gy
Low/Intermediate Risk (90%)
N=874

Hypo-Flame
Phase II
35 Gy in 5 Fx
Boost bis 50 Gy in 5 Fx
vs 36,25/7,25 Gy
Intermediate-High/Very High Risk (68%)
N=100

UNIVERSITÄTS KLINIKUM FREIBURG

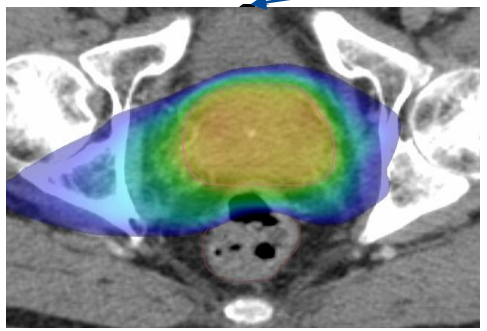
SBRT Studien – HypoFocal-SBRT

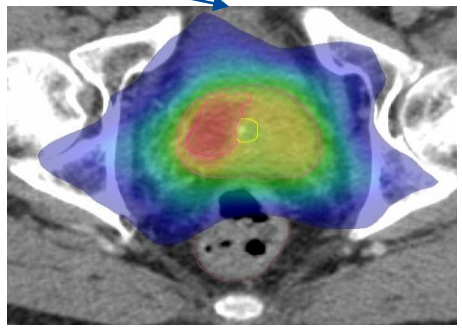
NATIONALE DEKADE GEGEN KREBS

UNIVERSITÄTS KLINIKUM FREIBURG

PI
Prof. Dr. med. Anca-Ligia Grosu
Co-PIs
PD Dr. med Simon Spohn
PD Dr. med Constantinos Zamboglou

Multizentrische, Randomisierte Phase III Studie
374 Patienten
Unfavorable intermediate-/high-risk PCa
cN0 and cM0 in PSMA-PET/CT und MRI
>20 Zentren in D, CH, A, CYP





Kontrollarm

MHRT
Prostata + SB
46.4 Gy in 20 Fraktionen
Prostata
60-62 Gy in 20 Fraktionen

Experimenteller Arm

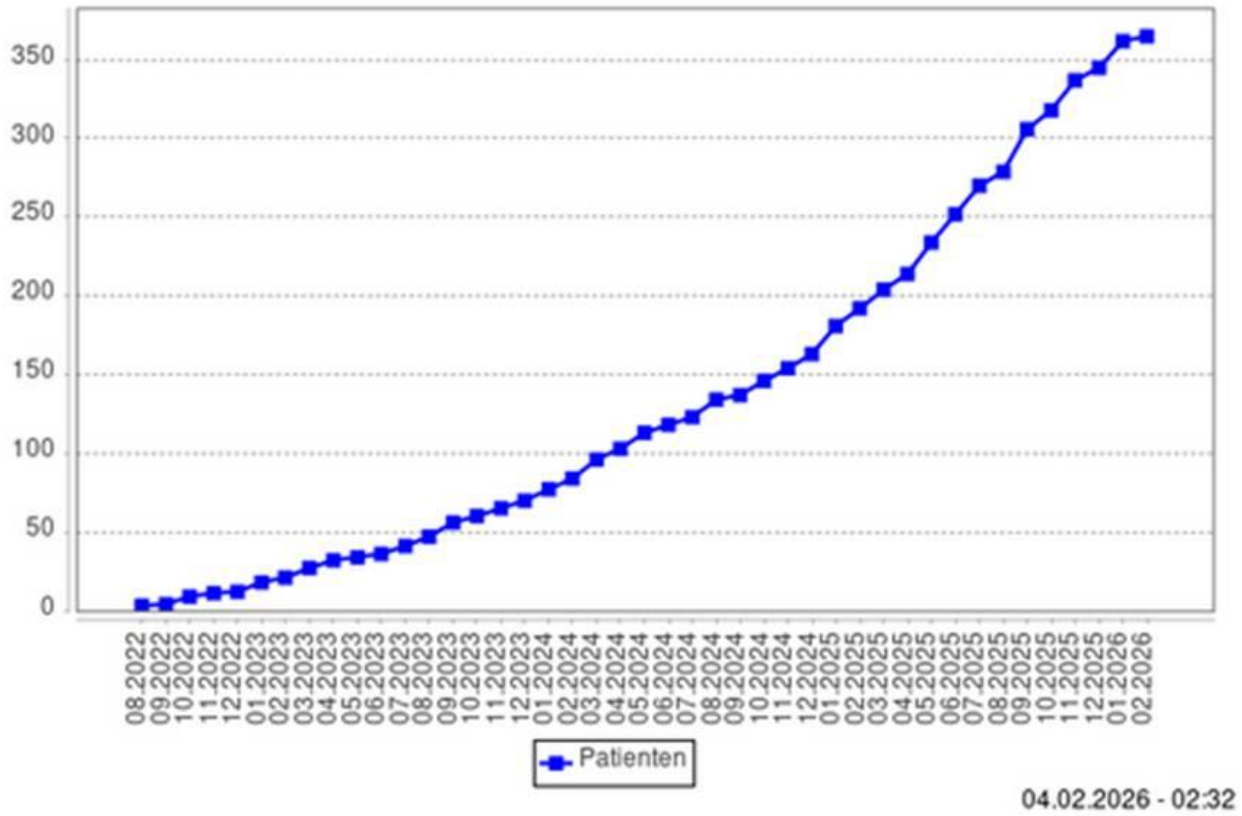
SBRT
Prostata + SB
30 Gy in 5 Fraktionen
Prostata
35 Gy in 5 Fraktionen
Fokaler Boost auf Basis PSMA-PET/mpMRT
40-42 Gy in 5 Fraktionen

SBRT Studien – HypoFocal-SBRT

NATIONALE DEKADE GEGEN KREBS

UNIVERSITÄTS KLINIKUM FREIBURG

PI
Prof. Dr. med. Anca-Ligia Grosu
Co-PIs
PD Dr. med Simon Spohn
PD Dr. med Constantinos Zamboglou



UNIVERSITÄTS KLINIKUM FREIBURG

Phase III Studien – unfavorable intermediate/high risk

HypoFocal-SBRT

HypoFlame 3.0

PACE-C

Brachytherapie vs. SBRT

Argument	Brachytherapie + EBRT	SBRT
Invasivität und Zeit		
Dosis		
Präzision		
Outcome und Toxizität		

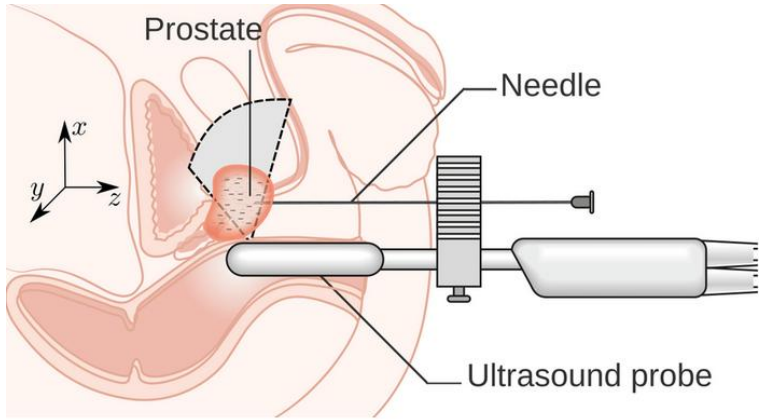
I Invasivität und Zeit

Brachytherapie + EBRT

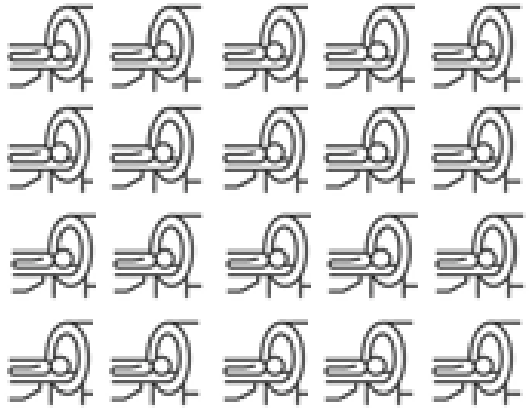
- <u>Prospektive Studien:</u>
- ASCENDE: LDR + 23 Fx EBRT
- Spohn et al: 1x HDR + 20 Fx EBRT
- Gomez-Iturriaga et al: 1x HDR + 15 Fx
- Hoskin et al: 2xHDR + 13 Fx EBRT
- Strouthos et al: 1x HDR + 13 EBRT

- <u>Retrospektive Studien:</u>
- Zelefsky et al: 1x HDR + 5 Fx EBRT

1-2 invasive Eingriffe

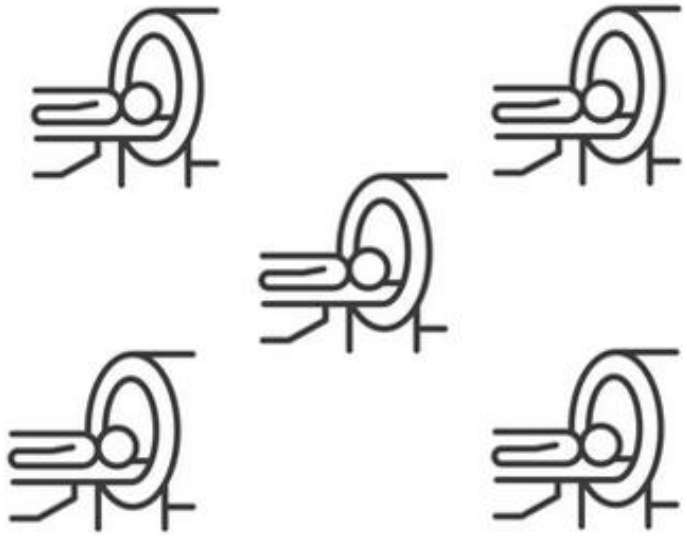


+



13-23 Fraktionen EBRT

I Invasivität und Zeit



0 Invasive Eingriffe,

„Nur“

5 Fraktionen

SBRT

- <u>Prospektive Studien:</u>

- HYPO-RT: 7 Fraktionen
- PACE A/B/C: 5 Fraktionen
- MIRAGE: 5 Fraktionen
- HypoFocal-SBRT: 5 Fraktionen
- HypoFlame: 5 Fraktionen
- HypoFlame 3.0: 5 Fraktionen
- Hypostat 3: 3 Fraktionen
- DESTINATION 2: 2 Fraktionen

Brachytherapie vs. SBRT

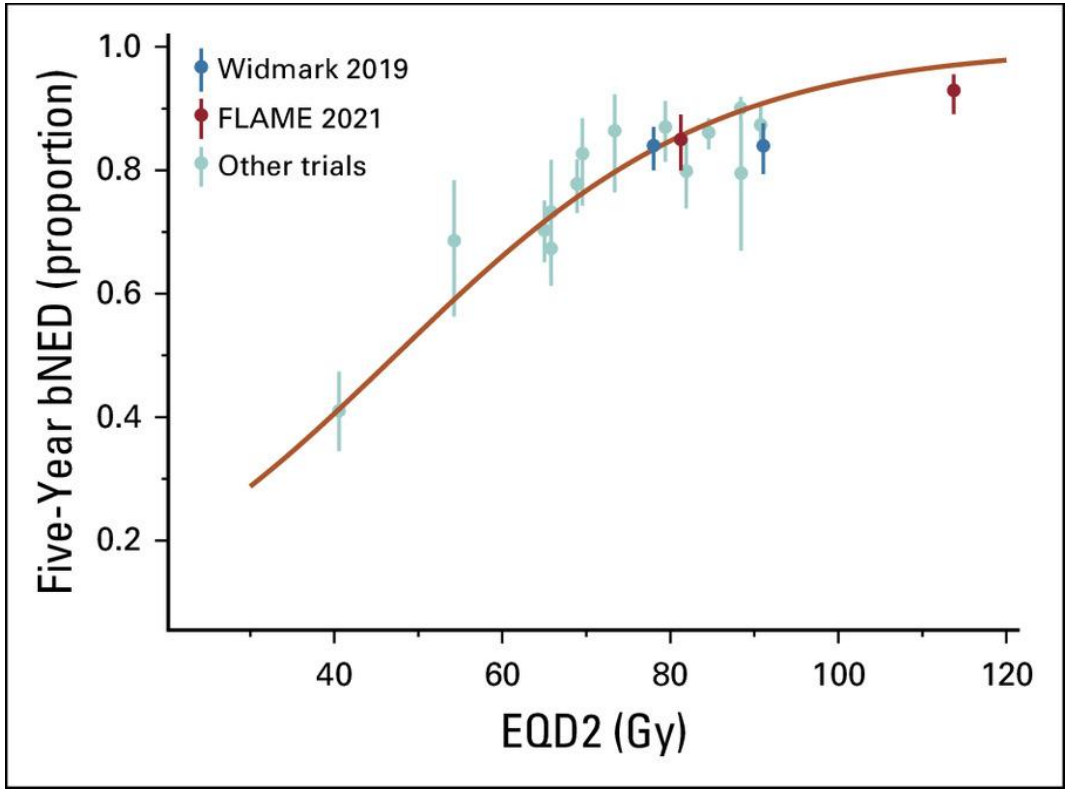
Argument	Brachytherapie + EBRT	SBRT
Invasivität und Zeit		
Dosis		
Präzision		
Outcome und Toxizität		

III Dosiseskalation und Inhomogenität

Brachytherapie + EBRT

1x 15 Gy + 46/2 Gy

115 Gy EQD2 a/b 1.6 Gy



SBRT

40/8 Gy

107 Gy EQD2 a/b 1.6 Gy

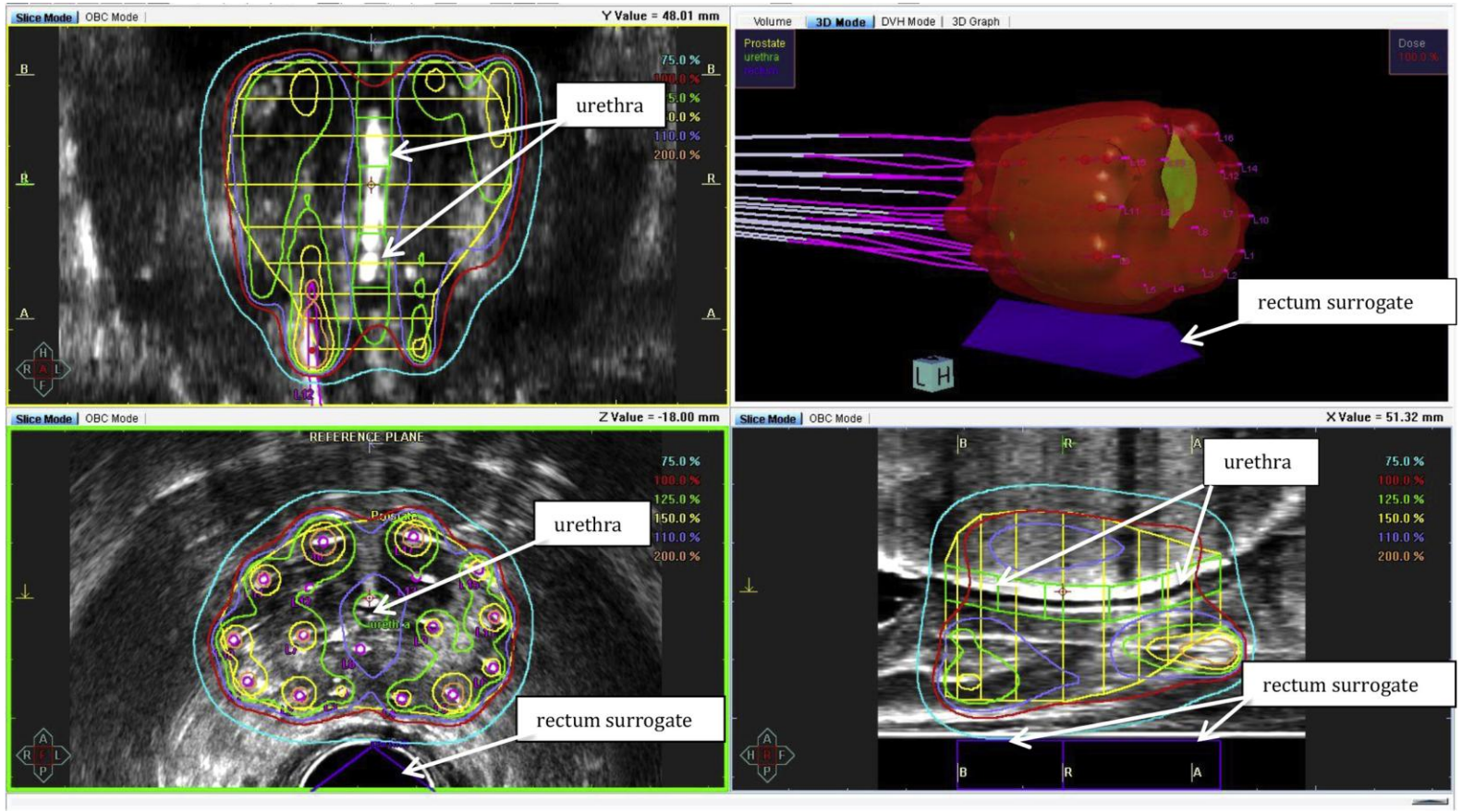
Vogelius et al., 2021 JCO

II Dosiseskalation und Inhomogenität

Brachytherapie + EBRT

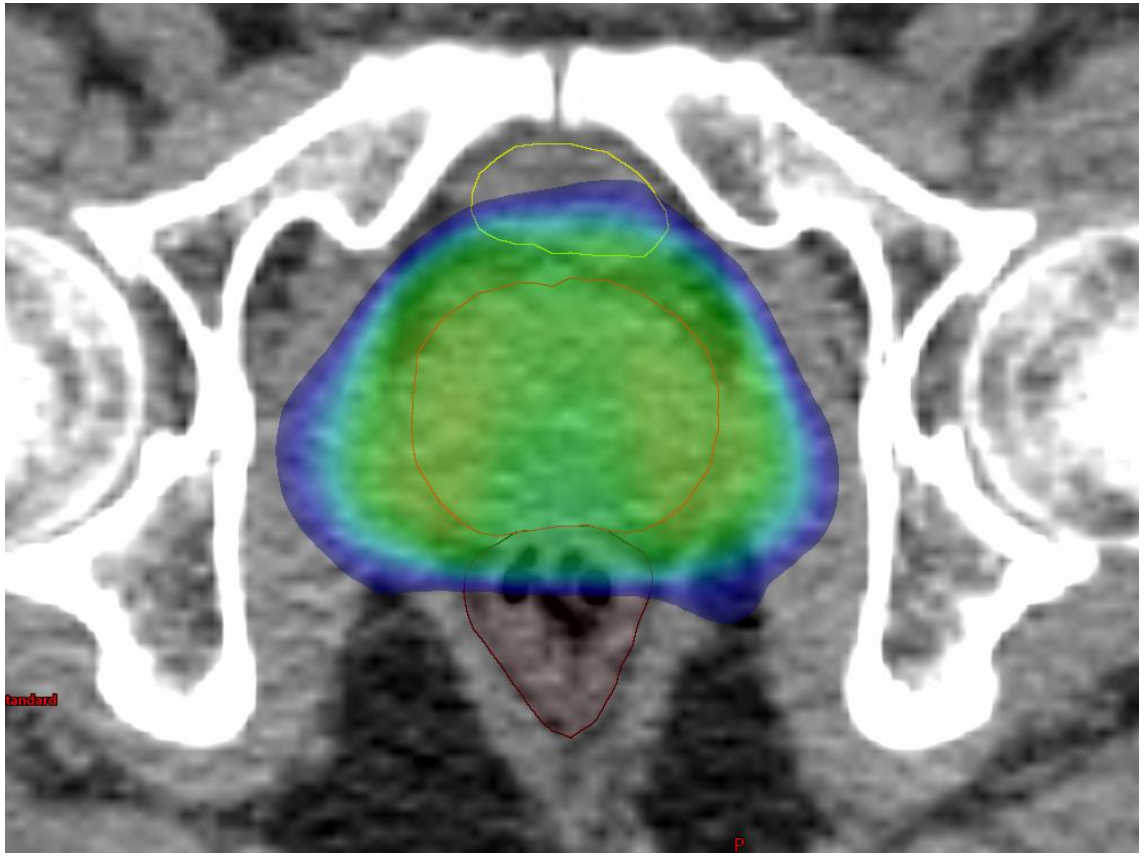
- Ausgeprägte Inhomogenitäten
- Dosisspitzen bis 200 % bei HDR

>200 Gy EQD2 a/b 1.6 Gy

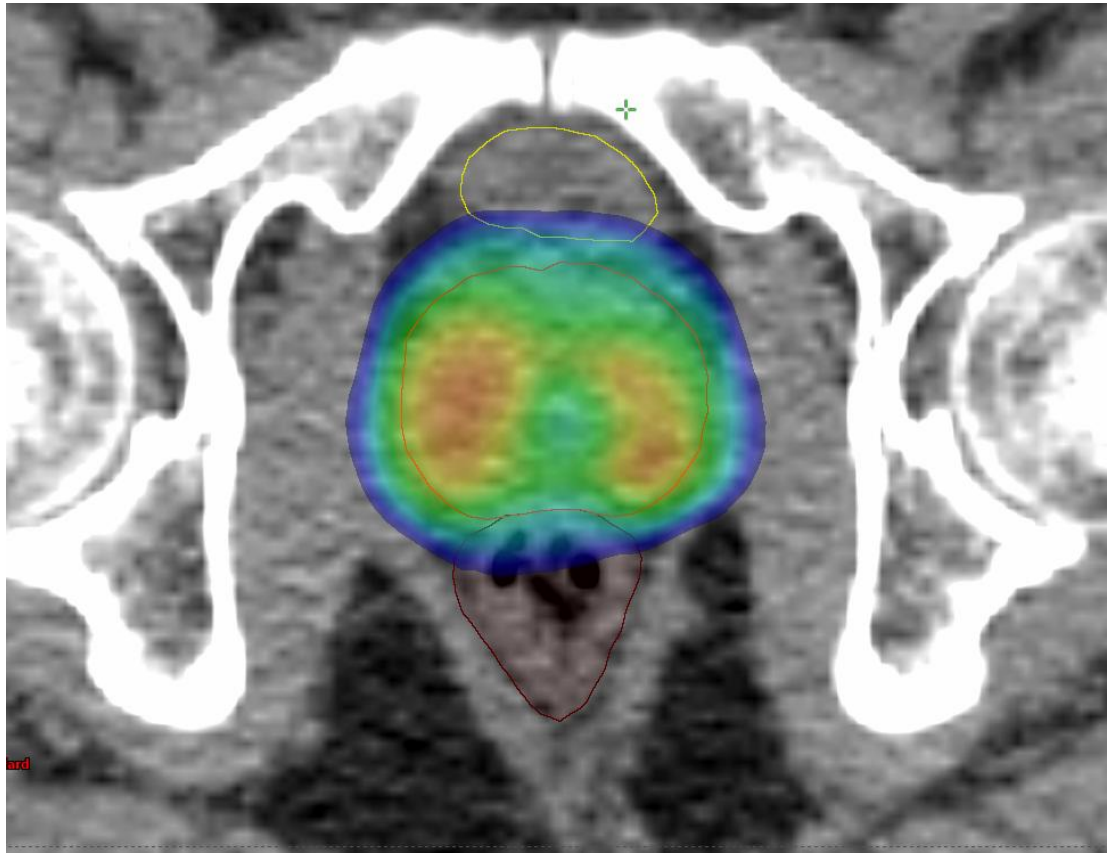


II Dosiseskalation und Inhomogenität

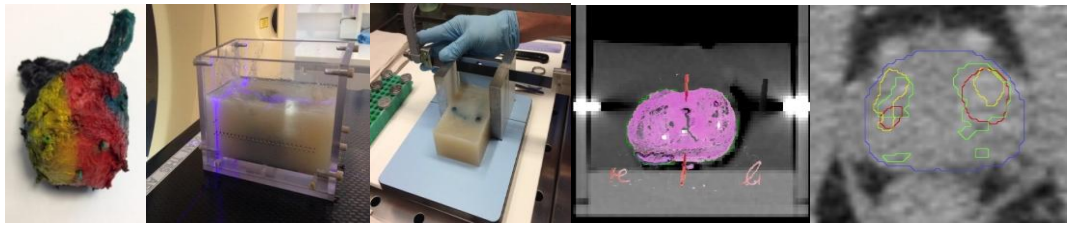
Homogene Bestrahlung



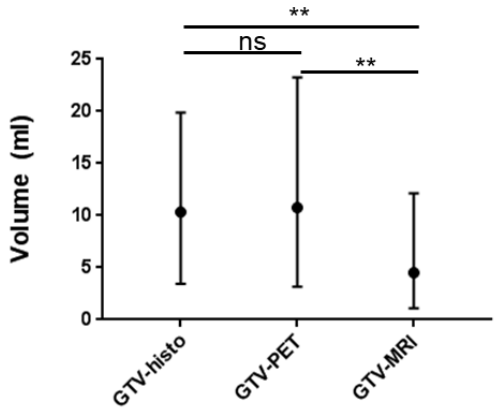
Fokale Dosiseskalation

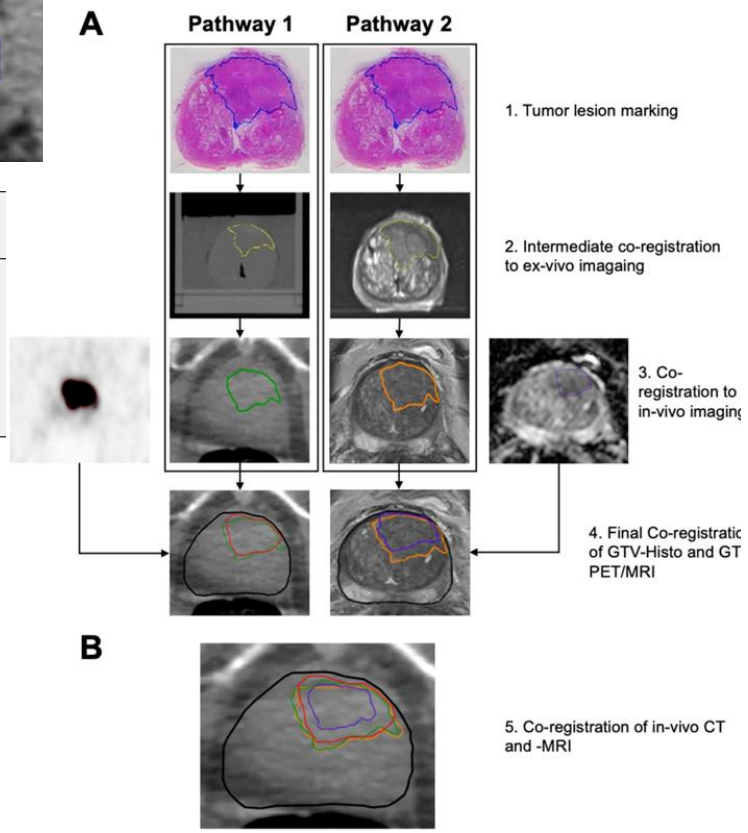


III Dosiseskalation und Inhomogenität



	PSMA-PET		MRI	
	Sensitivity	Specificity	Sensitivity	Specificity
Our study	0.86	0.87	0.58	0.94
Eiber et al. [20]	0.64	0.94	0.43/0.58*	0.82/0.98*
Rhee et al. [21]	0.49	0.95	0.44	0.94
Berger et al. [22]**	0.81	0.85	0.65	0.83
Kesch et al. [23]†	0.71	0.81	0.86	0.64
Chen et al. [24]	0.89	0.71	0.76	0.88
Hicks et al. [25]#			0.42	0.79





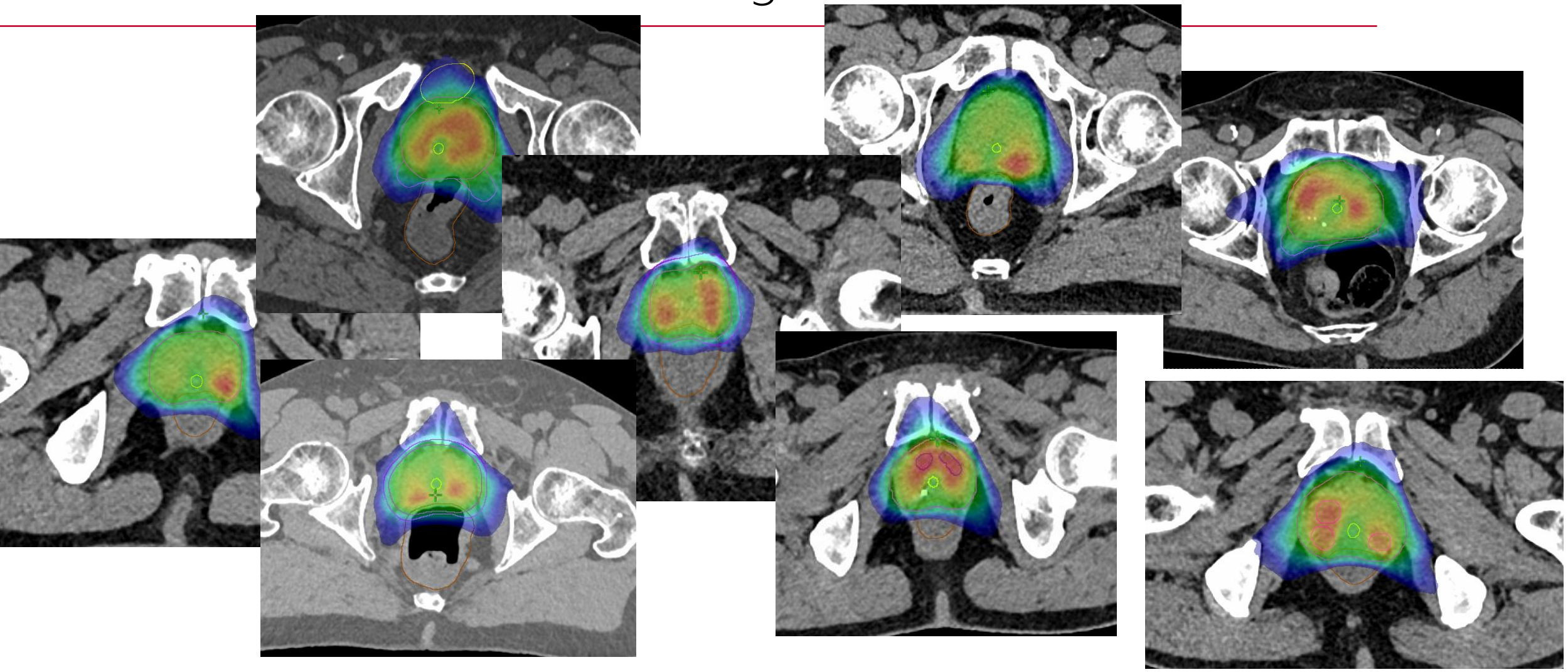
	Method	Quadrant and slice-by-slice	
		Registration pathway 1	Registration pathway 2
MRI	Sensitivity (%)	69.0 (61–80)	60.0 (51–74)
	Specificity (%)	100.0 (92–100)	100 (92–100)
PET	Sensitivity (%)	84.5 (73–96)	83.0 (63–96)
	Specificity (%)	93.8 (42–99)	74 (47–93)

Grosu et al. EJNMMI 2014
Zambgolou et al. Theranostics 2017
Zambgolou et al. Theranostics 2019
Bettermann et al., Radiother and Oncol 2019

Thomann…Grosu…Baltas Radiother Oncol 2018
Zamboglou … Grosu Radiati Oncology 2018
Spohn et al., Front. in Oncol 2021
Zamboglou … Spohn., Sci Rep 2021

UNIVERSITÄTS KLINIKUM FREIBURG

III Dosiseskalation und Inhomogenität



Dosiseskalation 42-50 Gy in 5 Fraktionen
EQD2 a/b 1.6 Gy = 117 – 160 Gy

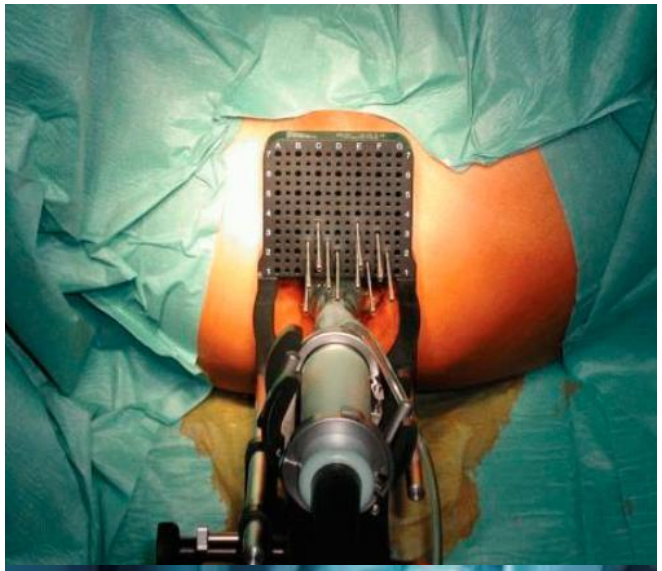
UNIVERSITÄTS KLINIKUM FREIBURG

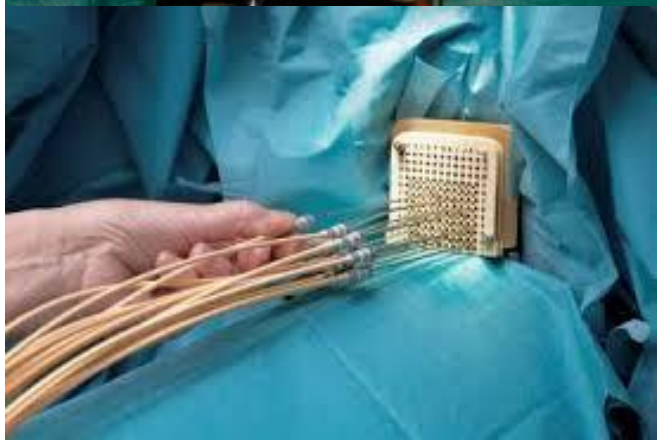
Brachytherapie vs. SBRT

Argument	Brachytherapie + EBRT	SBRT
Invasivität und Zeit		
Dosis		
Präzision		
Outcome und Toxizität		

III Präzision und Intrafraktionelle Kontrolle

Brachytherapie





- Brachytherapie fixiert Prostata,
- Keine intrafraktionelle Kontrolle notwendig
- Geringe Dosisungenauigkeiten

III Präzision und Intrafraktionelle Kontrolle

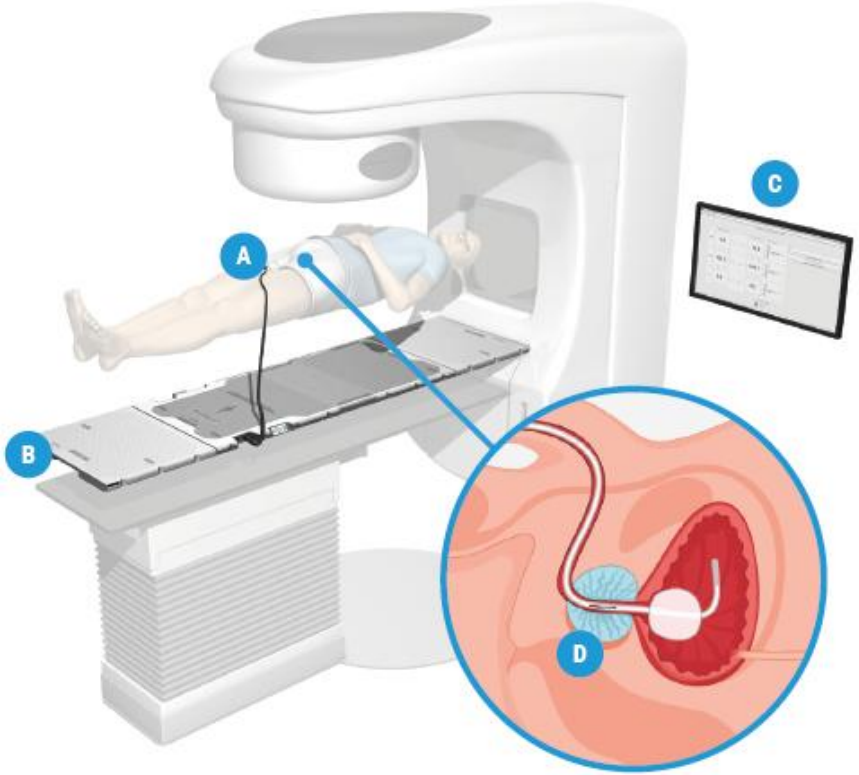
SBRT

<u>Dezidierte Systeme:</u>
Cyberknife
MR-Linacs

III Präzision und Intrafraktionelle Kontrolle

SBRT

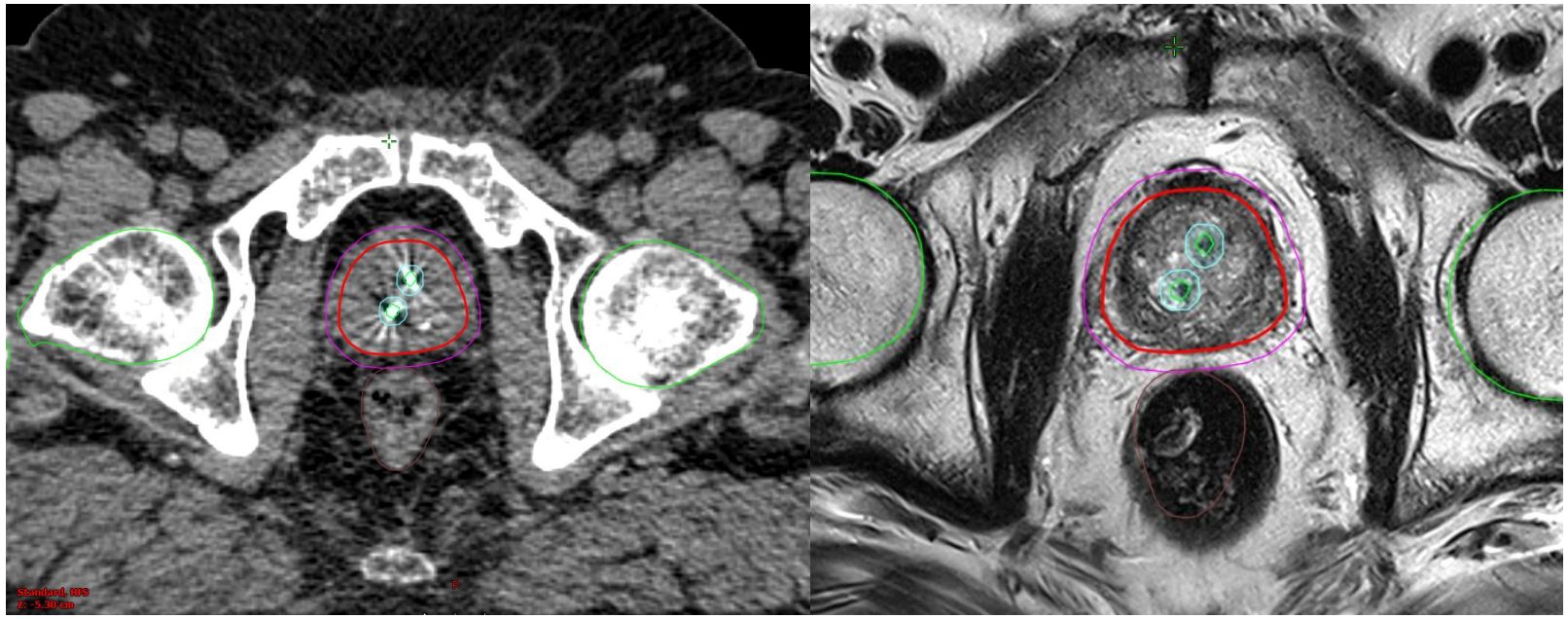
<u>Zusätzliche Tools:</u>
Claritiy
Raypilot Hypocath

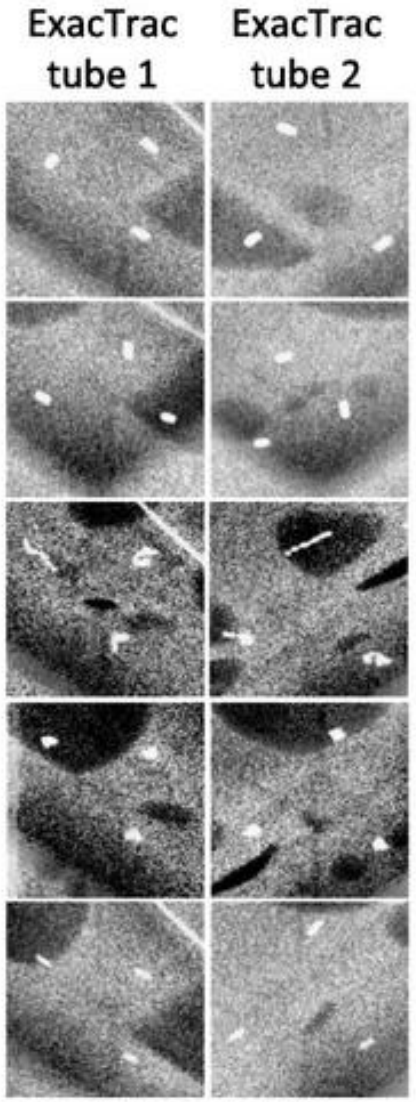


III Präzision und Intrafraktionelle Kontrolle

SBRT

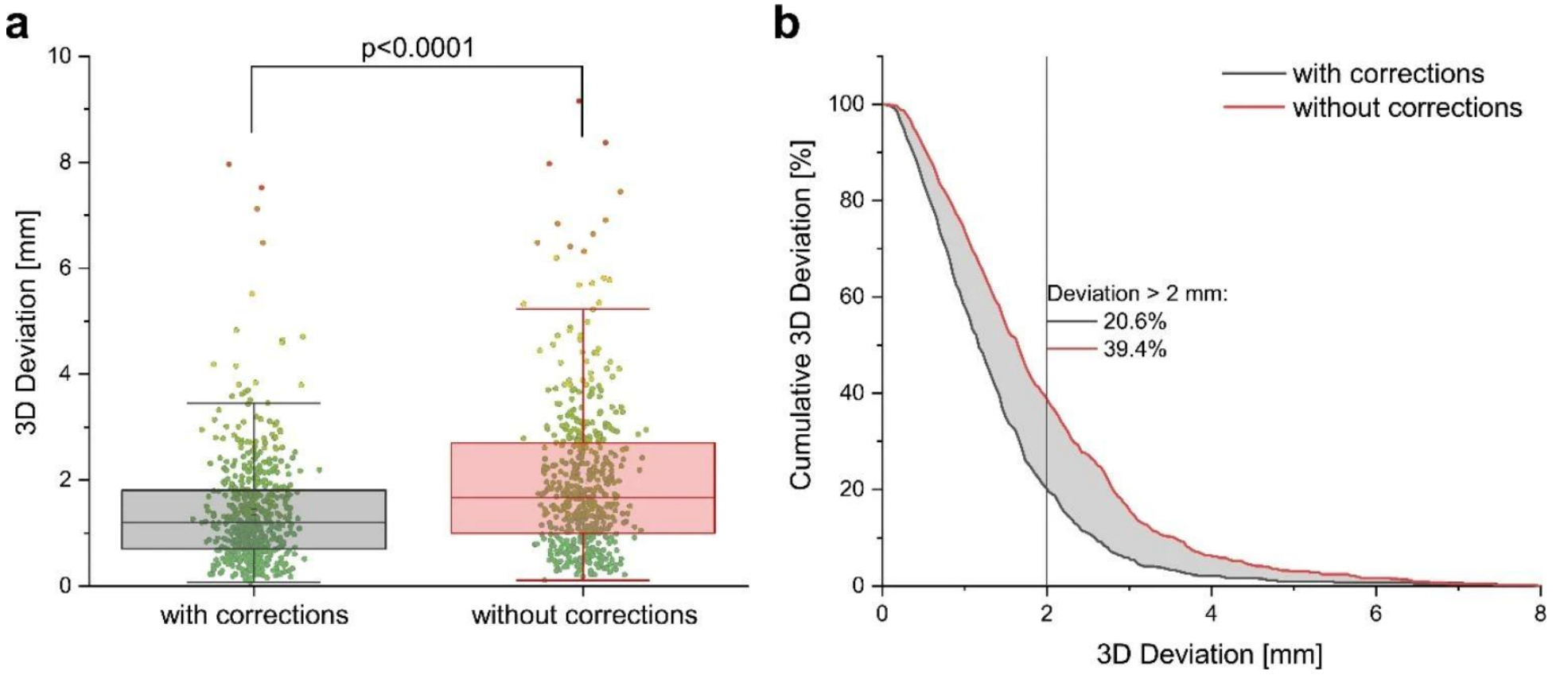
<u>Zusätzliche Tools:</u>
Goldmarker





Osman et al Radiaton Oncology, 2019

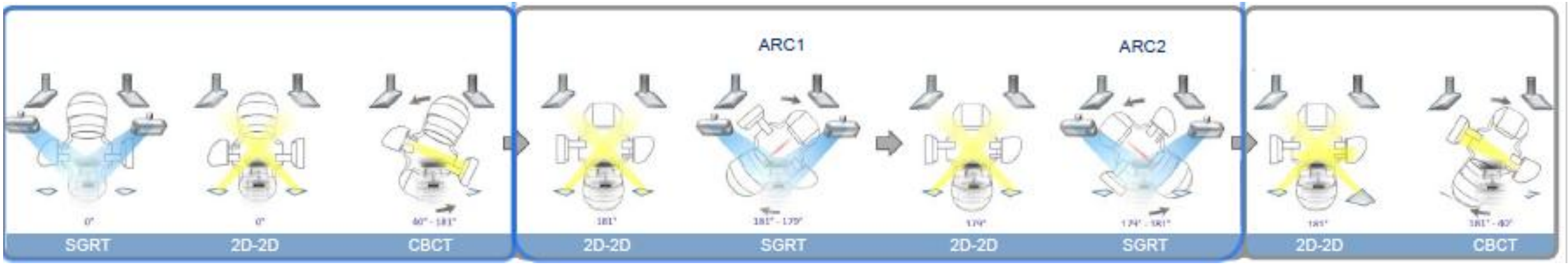
III Präzision und Intrafraktionelle Kontrolle



Mangesius et al., 2023 Physical and Engineering Sciences in Medicine

III Präzision und Intrafraktionelle Kontrolle

Freiburger Workflow
CBCT + 2D-2D/Exac Trac



Setup | Während der Bestrahlung | Nach der Bestrahlung

Serpa et al. … Spohn, under review

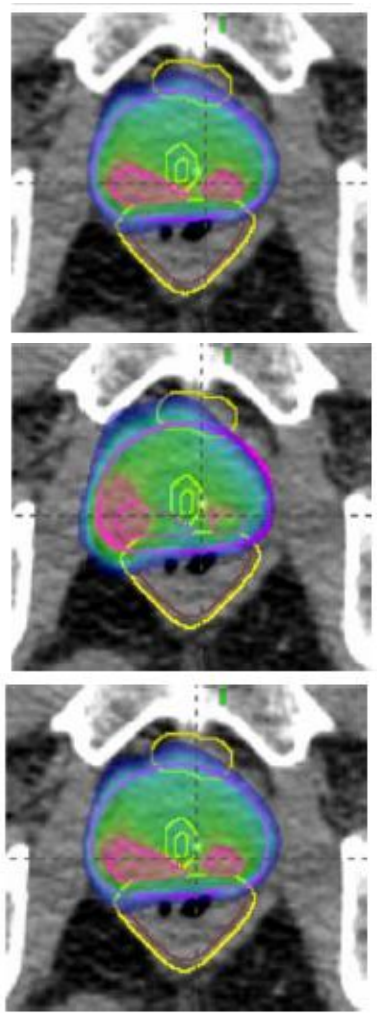
UNIVERSITÄTS KLINIKUM FREIBURG

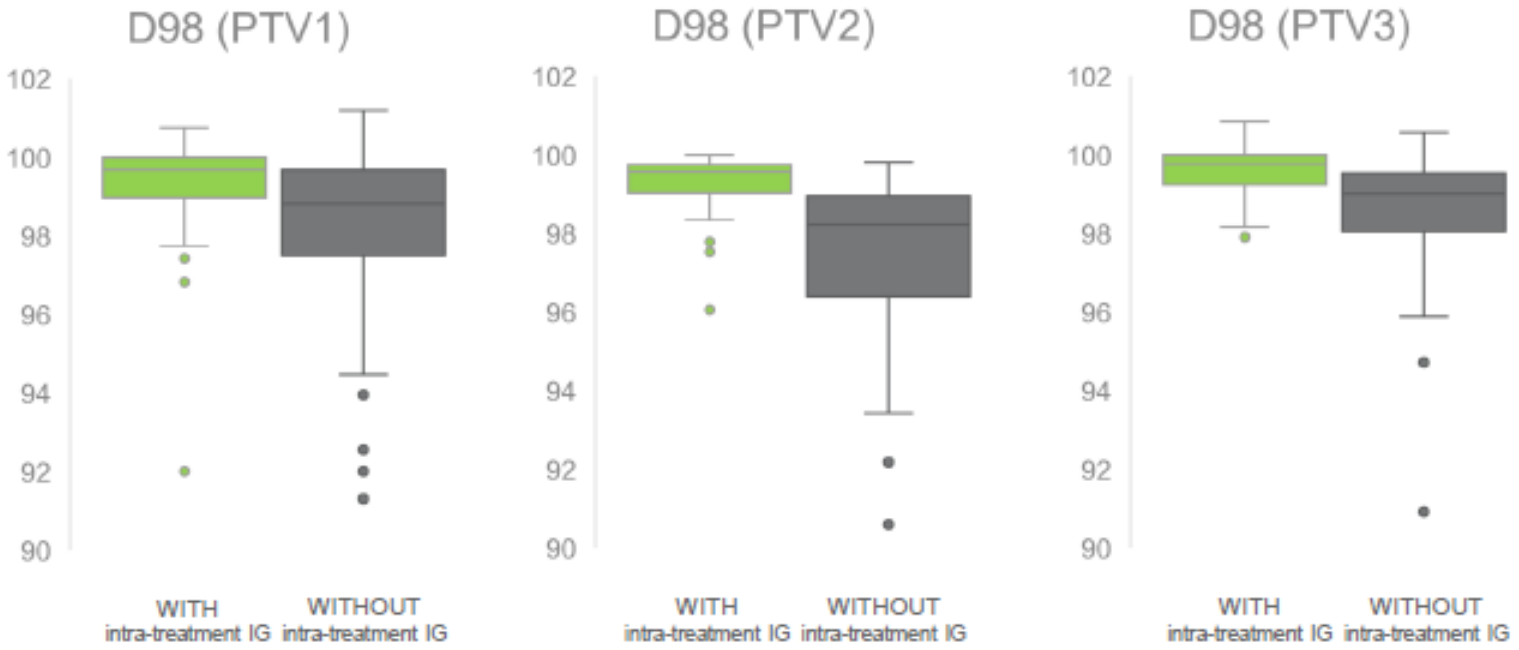
III Präzision und Intrafraktionelle Kontrolle

Geplant

Ohne Korrektur

Mit Korrektur





Serpa et al. … Spohn, under review

UNIVERSITÄTS KLINIKUM FREIBURG

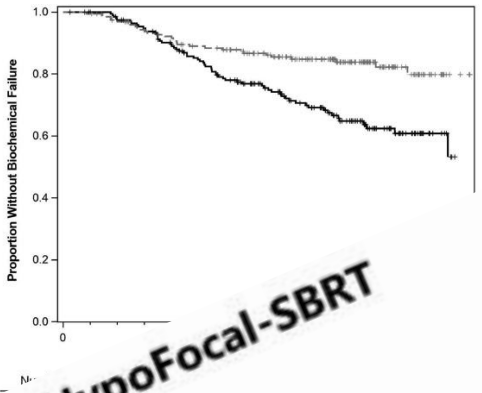
Brachytherapie vs. SBRT

Argument	Brachytherapie + EBRT	SBRT
Invasivität und Zeit		
Dosis		
Präzision		
Outcome und Toxizität		

IV Outcome

Brachytherapie + EBRT

ASCENDE RT Trial



HypoFocal-SBRT

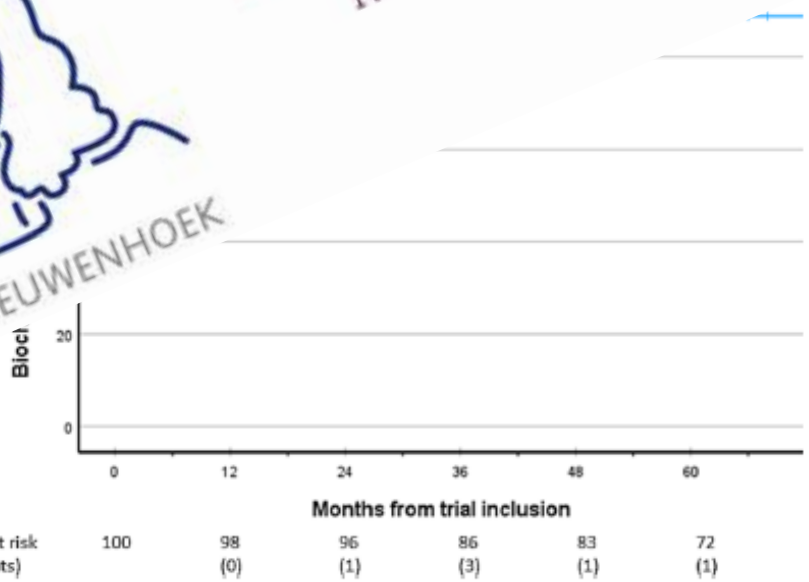
5 Jahr

HypoFlame 3.0

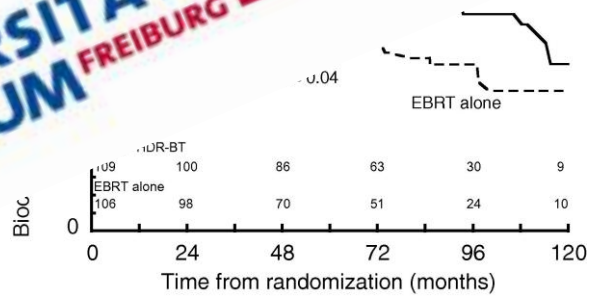
PACE-C

The ROYAL MARSDEN
NHS Foundation Trust

NETHERLANDS CANCER INSTITUTE
ANTONI VAN LEEUWENHOEK



UNIVERSITÄTS KLINIKUM FREIBURG

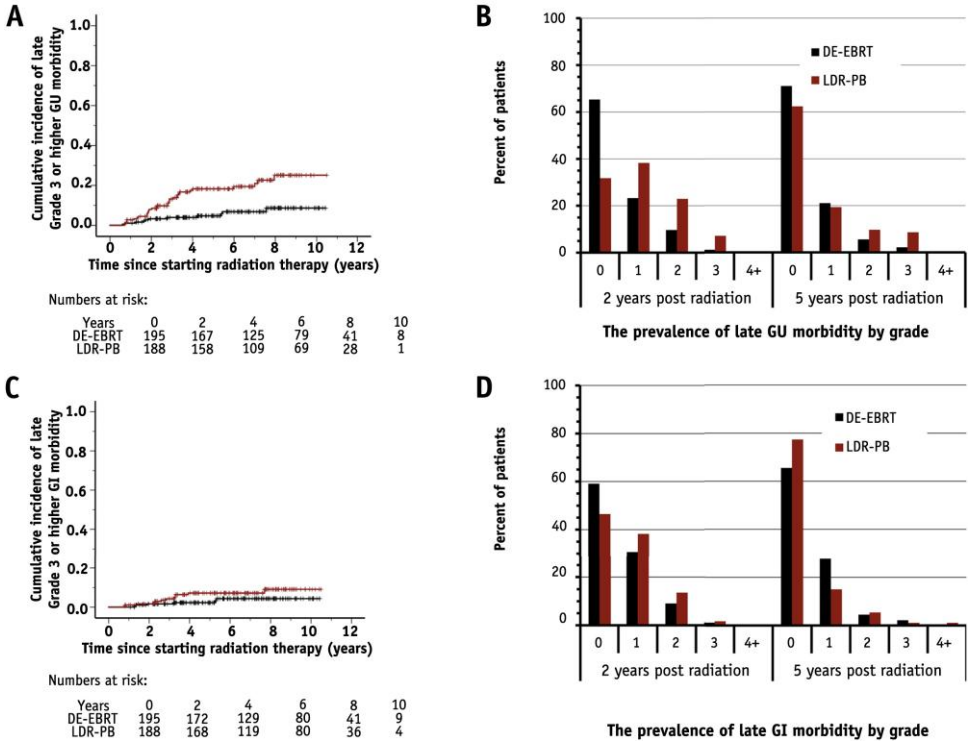


5 Jahres biochemische Kontrolle 93%

IV Toxizität

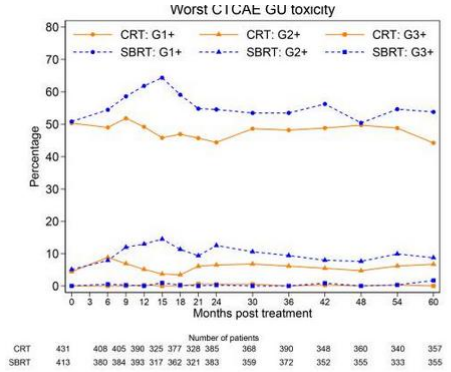
Brachytherapie + EBRT

ASCENDE RT Trial

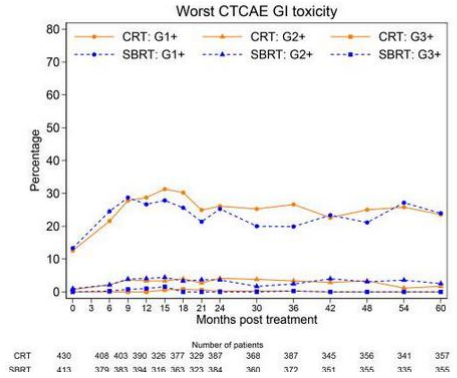


SBRT

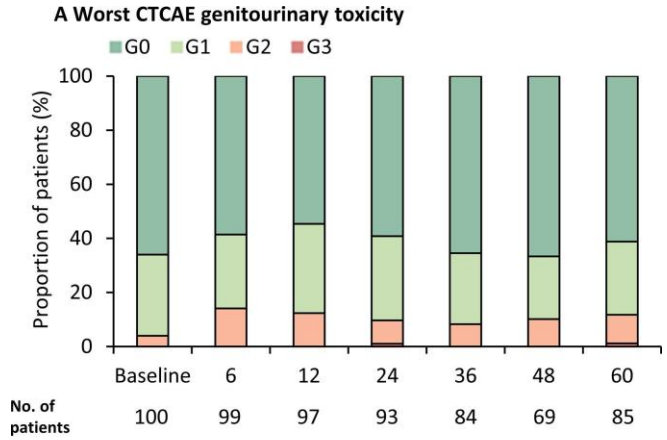
PACE-B

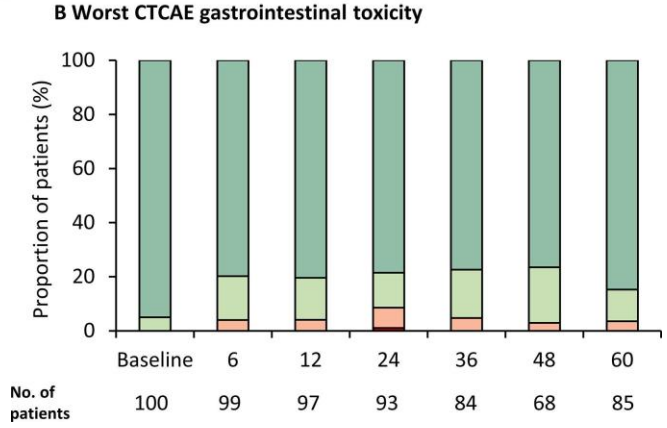


(D) Prevalence of grade≥1, grade≥2 and grade≥3 CTCAE Gastrointestinal toxicity at each time point assessed by treatment received



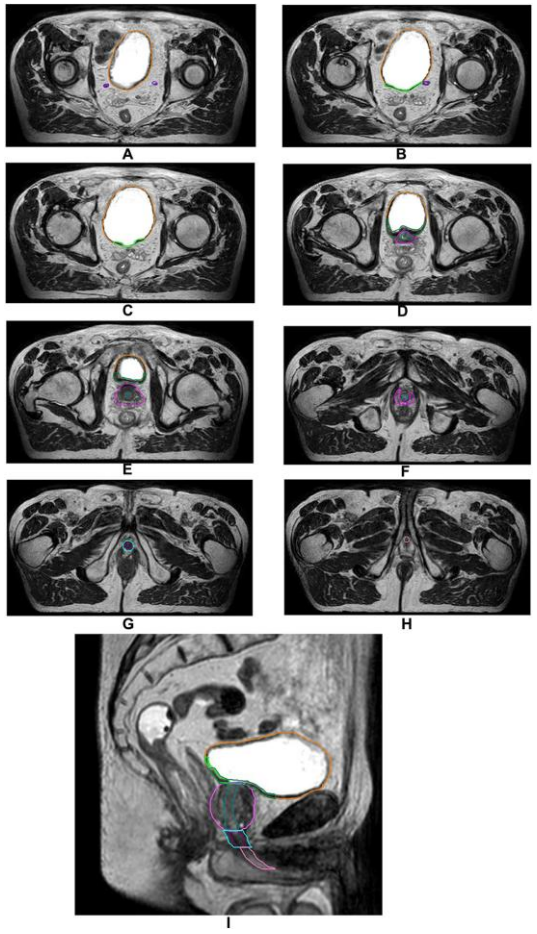
HypoFlame



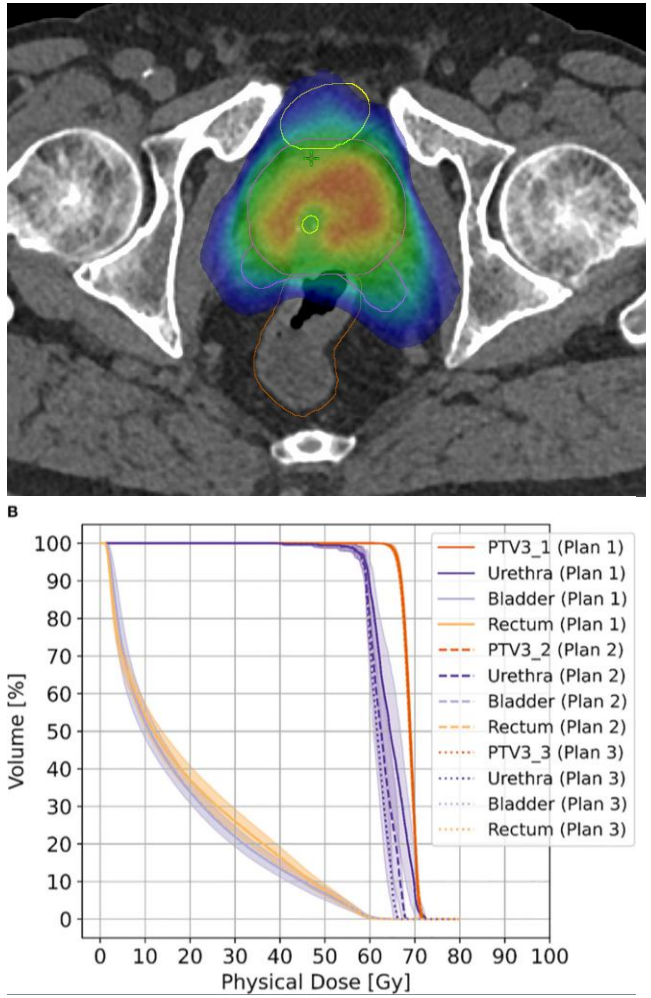


UNIVERSITÄTS KLINIKUM FREIBURG

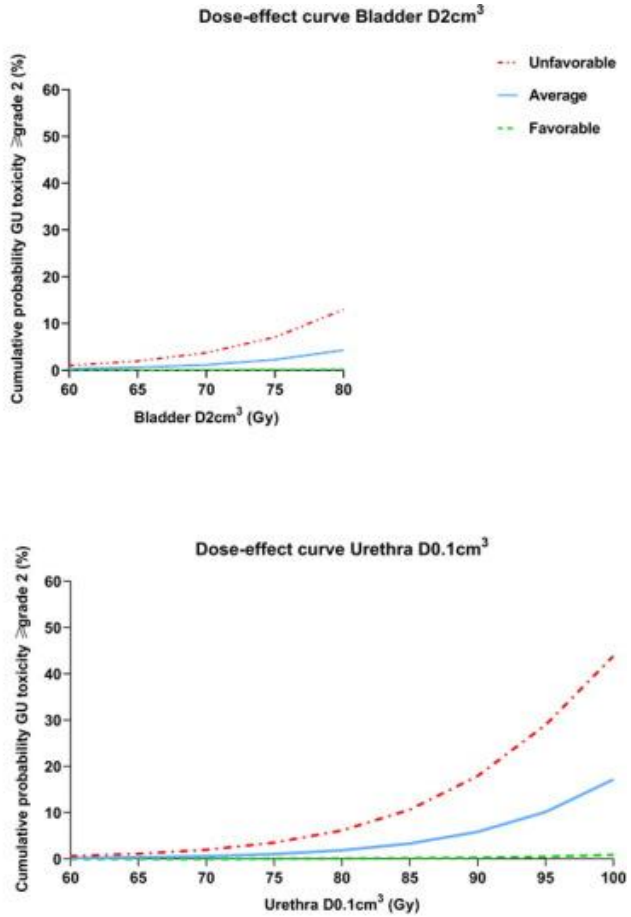
IV Outcome und Toxizität



Guévelou et al., Pro 2024



Spohn et al. Front Onc 2021



Groen et al., Radio Onc 2022

UNIVERSITÄTS KLINIKUM FREIBURG

Brachytherapie vs. SBRT

Argument	Brachytherapie + EBRT	SBRT
Invasivität und Zeit		
Dosis		
Präzision		
Outcome und Toxizität		

Zusammenfassung

- **Moderne SBRT** mit interfraktionellem Tracking, engen Margins, fokaler Dosiseskalation und Integration funktioneller Bildgebung ist eine
  - Nicht invasive
  - Schnell durchzuführende
  - Hocheffektive
  - Gut verträgliche

  Therapieoption für Patienten mit Prostata-Ca (Phase III Ergebnisse bzgl high risk Patienten ausstehend)

- Weitere Optimierung sind zu erwarten
  - Optimale Dosis
  - Optimale OAR constraints
  - Verbessertes intrafraktionellen Tracking

Danke für Ihre Aufmerksamkeit

@Simon_Spohn

Simon Spohn

Simon.Spohn@uniklinik-freiburg.de

DKTK
Deutsches Konsortium für Translationale Krebsforschung

Faculty of Medicine
BERTA-OTTENSTEIN-PROGRAM
FOR [ADVANCED] CLINICIAN SCIENTISTS

UNIVERSITÄTS KLINIKUM FREIBURG
CCCF COMPREHENSIVE CANCER CENTER FREIBURG

dkfz.
German Cancer Consortium
Partner site Freiburg