A Whole New World: *A Magic Carpet Ride Though Prostate Planning's Past, Present & Future*

Presented By: Melissa Nolet

Monday, 6/8/2026

AAMD's 51st Annual Meeting

"Where the Real Magic Happens"

1

Disclosures

I have no financial relationships or conflicts of interest to disclose related to this presentation.

This Presentation:

- Is provided as an educational service
- Case Studies are utilizing
  - Varian TPS 16.01.10
  - Varian TB Version 02.07.4001

2

Overview

- Understand a brief history of prostate planning
- Planning tips and tricks using case studies
- Implement effective multidisciplinary communication strategies to optimize treatment plans
- Review emerging future technologies and strategies

3

About Me

- CMD of 15 years with 7 years at Northside Hospital Cancer Institute
- I plan for all sites with a special emphasis on Prostate combination therapy EBRT and HDR
- NSM Clinic is a state-of-the-art, ambulatory facility with a dedicated clean OR for outpatient HDR procedures
- Location is Midtown
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NORTHSIDE HOSPITAL

BUILT TO BEAT CANCER

4

Prostate Anatomy & Physiology

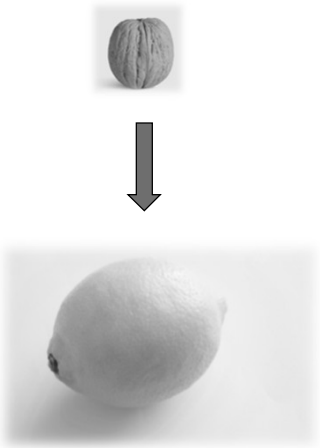
Unique Growth Pattern:

The prostate is the only organ in the male body that continues to grow after age 25, with two distinct growth phases.

Pubertal Development: During puberty, the prostate rapidly doubles in size to approximately 20 cc (walnut-sized) and begins producing a significant portion of the fluid in semen

Adult Growth Phase: After reaching adult size, the prostate enters a slow, continuous growth phase of 1–3% per year throughout a man's life

Benign Prostatic Hyperplasia (BPH): By age 60 many men have noticeable enlargement; by ages 80–85, up to 90% of men develop BPH, which can enlarge the prostate to lemon size and commonly causes urinary symptoms by compressing the urethra



5

Prostate Anatomy & Physiology

Anatomy

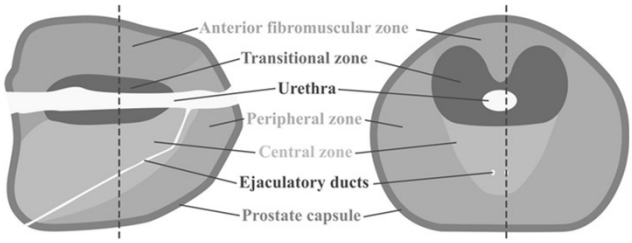
- Divided into distinct zones,
  - peripheral zone being the most common site of prostate cancer origin

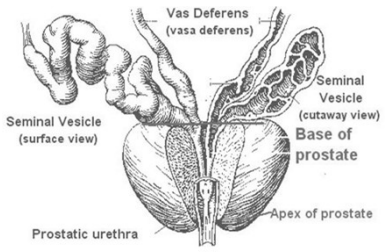
Histology

- The prostate is composed of glandular tissue organized into acinar glands embedded in a fibromuscular stroma
- These acini produce prostatic fluid

Physiology

- The prostate produces approximately 20–30% of seminal fluid
- Contributing key components such as PSA, citric acid, and enzymes that help liquefy semen & support sperm motility and survival





6

Prostate Cancer Statistics

America Cancer Society (ACS) 2025 Report

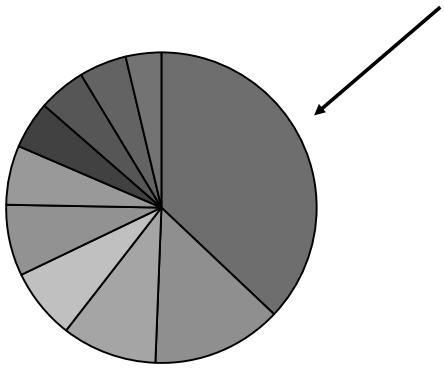
Estimated New Cases

Male			Female		
Prostate	313,780	30%	Breast	316,950	32%
Lung & bronchus	110,680	11%	Lung & bronchus	115,970	12%
Colon & rectum	82,460	8%	Colon & rectum	71,810	7%
Urinary bladder	65,080	6%	Uterine corpus	69,120	7%
Melanoma of the skin	60,550	6%	Melanoma of the skin	44,410	4%
Kidney & renal pelvis	52,410	5%	Non-Hodgkin lymphoma	35,210	4%
Non-Hodgkin lymphoma	45,140	4%	Pancreas	32,490	3%
Oral cavity & pharynx	42,500	4%	Thyroid	31,350	3%
Leukemia	38,720	4%	Kidney & renal pelvis	28,570	3%
Pancreas	34,950	3%	Leukemia	28,170	3%
All sites	**1,053,250**		**All sites**	**988,660**	

Estimated Deaths

Male			Female		
Lung & bronchus	64,190	20%	Lung & bronchus	60,540	21%
Prostate	35,770	11%	Breast	42,170	14%
Colon & rectum	28,900	9%	Pancreas	24,930	8%
Pancreas	27,050	8%	Colon & rectum	24,000	8%
Liver & intrahepatic bile duct	19,250	6%	Uterine corpus	13,860	5%
Leukemia	13,500	4%	Ovary	12,730	4%
Esophagus	12,940	4%	Liver & intrahepatic bile duct	10,840	4%
Urinary bladder	12,640	4%	Leukemia	10,040	3%
Non-Hodgkin lymphoma	11,060	3%	Non-Hodgkin lymphoma	8,330	3%
Brain & other nervous system	10,170	3%	Brain & other nervous system	8,160	3%
All sites	**323,900**		**All sites**	**294,220**	

Male Estimated New Cases Pie Chart

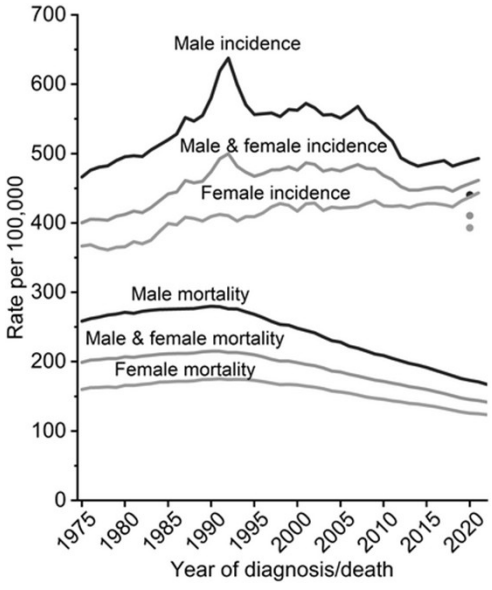


7

Prostate Cancer Statistics

Incidence

- Approximately 1 in 8 men will be diagnosed with prostate cancer
- Incidence rates declined sharply from 2007–2014
- Since 2014, incidence has been <u>rising about 3% per year</u>
- <u>Most concerning:</u> Advanced-stage disease rising 4.6% – 4.8% per year



8

Detection & Awareness

A Historic Moment in Prostate Cancer Awareness

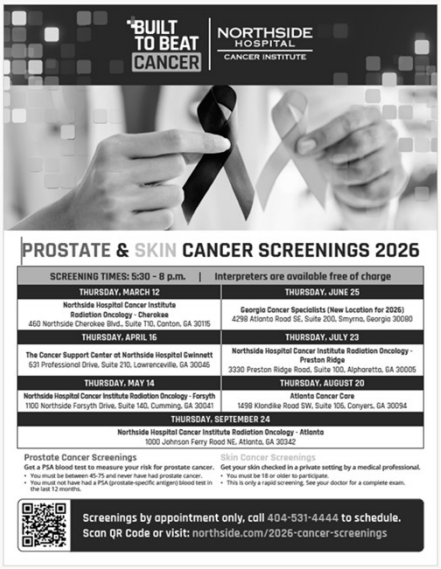
2026 was the first Prostate cancer screening awareness commercial for the Super Bowl

9

Detection & Awareness

Northside Hospital Prostate Screenings

- **Active Community Screening Program**
  - 14% increase from the previous year
- **Targeted Outreach**
  - African American Men are at higher risk
- **Simple PSA blood test**
  - 14% receiving abnormal results requiring further evaluation
- **Strong Patient Support & Navigation**
  - Prompt follow-up
  - Physician referrals, financial assistance information and coordinated care though affiliated urology practices



10

Risk Stratification

NCCN Risk Group: Clinical + Pathological Risk

- PSA
- Gleason Score (Grade)
- TNM Staging

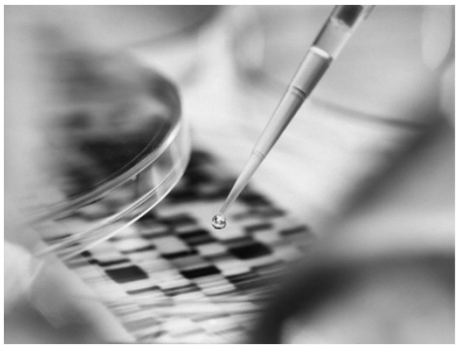
Decipher Score: Genomic or Biological Risk

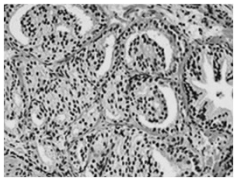
Risk Group	Key Defining Features
Very Low	PSA <10, Grade Group 1, T1c, <3 positive cores (<50% cancer each), PSA density <0.15
Low	PSA <10, Grade Group 1, T1–T2a (does not meet Very Low criteria)
Favorable Intermediate	PSA 10–20 or Grade Group 2 or T2b–T2c, with limited unfavorable features
Unfavorable Intermediate	More aggressive intermediate features (e.g., Grade Group 3, multiple intermediate factors, high % positive cores)
High	PSA >20 or Grade Group 4–5 or T3a
Very High	Multiple high-risk features, T3b–T4, primary Gleason pattern 5, or ≥4 cores with GG 4–5 (updated criteria in 2025)

11

Decipher Score by Veracyte

- Measures the expression of 22 genes in prostate cancer tissue to convey tumor aggressiveness and disease progression risk
- How does this influence Dosimetry?
  - Treatment volume (prostate only vs. pelvis)
  - Dose/fractionation considerations
  - Use of focal boosts or dose painting
  - Greater assurance in opting for de-escalated treatment protocols





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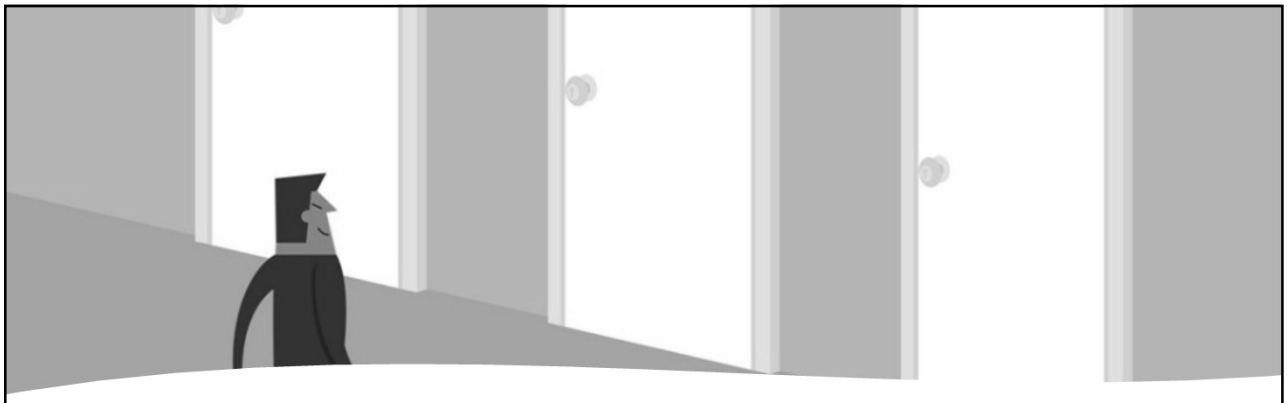


Treatment Options

1. Active Surveillance (low risk)
2. Surgery: RALP (robot-assisted laparoscopic radical prostatectomy)
3. Radiation
   a. Photon Therapy
   b. Proton Therapy
   c. Brachytherapy — LDR or HDR
4. Androgen Deprivation Therapy (ADT)

Treatment is highly personalized based on NCCN Risk Group, Decipher score, patient age, comorbidities, and preferences.

13

History of Prostate Cancer Treatment: Overview

14

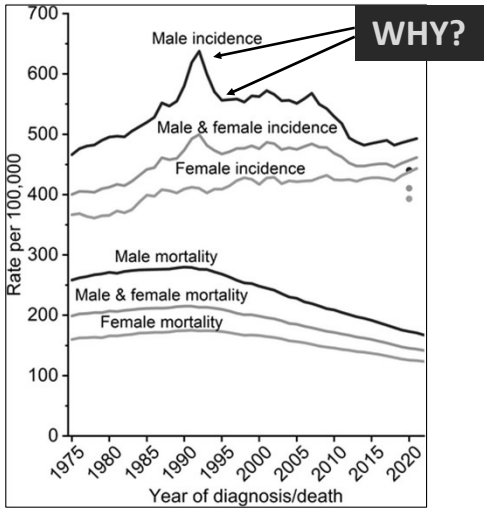
History: Detection & Diagnosis

1853	First histologically confirmed case described by J. Adams (London) • diagnosed at autopsy/advanced stage. Prostate cancer considered "very rare."
1900-1970s	Diagnosis primarily by Digital Rectal Exam (DRE) and symptoms (urinary obstruction, bone pain) • Most cases found late-stage/advanced.
1970	Introduction of Transrectal Ultrasound (TRUS) • improved visualization and enabled systematic biopsies.
1986	FDA approves PSA blood test initially for monitoring treatment response.
1990	Landmark studies establish PSA as a screening tool • dramatic increase in early-stage detections.
1990-2000s	TRUS-guided systematic biopsies become standard • PSA + DRE combination widely adopted.

15

History : Detection & Diagnosis

The shift from symptom-driven, late-stage diagnosis to PSA early detection has been one of the MOST IMPACTFUL advances in prostate cancer care



16

History : ADT

1941:

Charles Huggins

- Found Androgen dependance
- Demonstrated regression of metastatic prostate cancer with surgical castration
- Received Nobel Prize 1966

1980-1990s:

LHRH agonists approved—Term **"Androgen Deprivation Therapy (ADT)"** becomes widely adopted in literature and clinical practice

- Non-invasive medical castration
- Reversable vs the alternative of surgical removal of testes

2000s–2010s:

Research continues with next-generation agents

- (Abiraterone, Enzalutamide, Apalutamide, Darolutamide) + combination strategies

17

History : Surgery

1904: Hugh Hampton Young performs the first radical perineal prostatectomy at Johns Hopkins

1940s–1950s: Terence Millin popularizes the radical retropubic prostatectomy

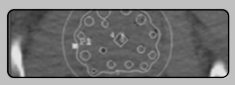
1982: Patrick Walsh develops anatomic nerve-sparing radical prostatectomy

1990s: Introduction of laparoscopic radical prostatectomy

2000s–Present: Robotic-assisted laparoscopic prostatectomy (RALP) using da Vinci system becomes the dominant approach in the U.S. (>90% of cases)

18

History : Brachytherapy



LDR dates back to the early 20th century with radium needles inserted via urethral or transperineal approaches; modern permanent seed implants (primarily I-125) were refined in the 1970s–1980s using open surgical techniques

Early Beginnings (1900s–1970s): Brachytherapy.

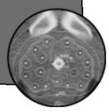
- Radiation Pla[illegible]g

In 1983, the transrectal ultrasound (TRUS)-guided technique, dramatically improved LDR seed placement accuracy and enabled a shift toward outpatient procedures with better treatment planning.

Ultrasound-Guided Revolution (1980s):

HDR was first reported around **1990**; it was developed to overcome limitations of permanent LDR seeds, offering better dose optimization and urethral sparing through real-time planning.

HDR Emergence 1990s



HDR became a viable and widely accepted option with its feasibility and safety as a boost with external beam radiation for intermediate- and high-risk patients.

Clinical Adoption (Mid-1990s onward):

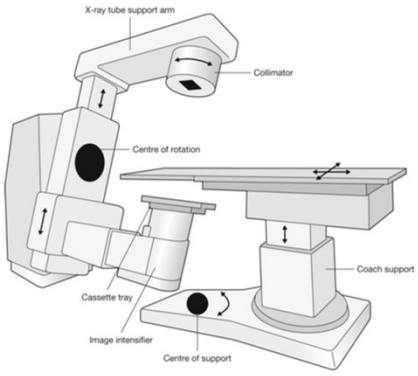
19

History: *Radiation Treatment Planning*

Pre-CT Radiation Therapy Simulation used specialized machines that closely resembled a linear accelerator but used diagnostic X-rays & Fluoroscopy instead of therapeutic MV beams

Used bony landmark alignment, and skin wire for 2D Planning

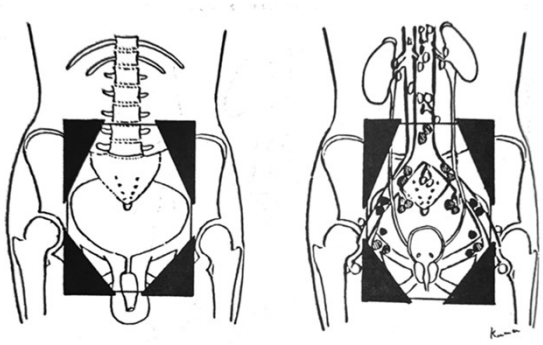
Higher uncertainty in target volume definition due to poor soft tissue visualization



20

History: *Radiation Treatment Planning*

- Treatment Technique
  - Octagonal field with the standard Cerrobend block
  - **AP and PA** fields were used in patients up to 25cm separation
  - Four field technique was used in a separation >25cm.
  - The upper margin extends up to L4
  - The lower margin extends to the ischial tuberosities
  - The lateral margins extend 1-2cm beyond the pelvic brim
- Goal: to encompass the primary and all the lymph nodes at risk
- Initial Dose: 40Gy in 20 fractions

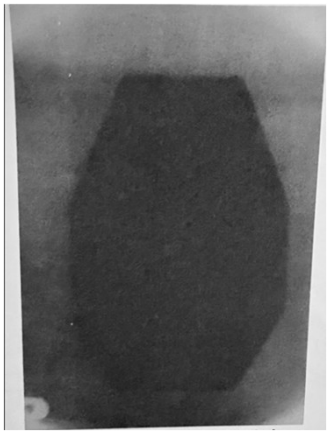


21

History: *Radiation Treatment Planning*

- External Beam Radiotherapy
  - Treatment Technique
    - Octagonal field with the standard Cerrobend block
    - AP and PA fields are used in patients >25cm
    - The upper margin extends up to L4
    - The Lower margin extends to the ischial tuberosities
    - The lateral margins extend 1-2cm beyond the pelvic brim
  - Goal: to encompass the primary and all the lymph nodes at risk
  - Initial Dose: 40Gy in 20 fractions

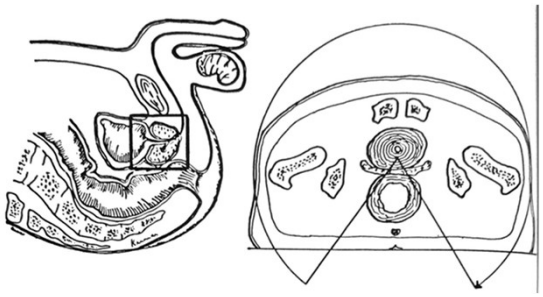
6MV Port Film



22

History: *Radiation Treatment Planning*

- External Beam Radiotherapy
  - Treatment Technique
    - Lateral pelvic x-ray with a rectal probe and contrast in the bladder was taken to localize the prostate
    - 270 degree anterior arc technique was used with an 8cm x 8cm field
  - Goal: to deliver a tumoricidal dose to the primary Prostate without exceeding bowel tolerance
  - Boost Dose: 30Gy in 15 fractions
    - Total Prostate Dose = 70Gy



23

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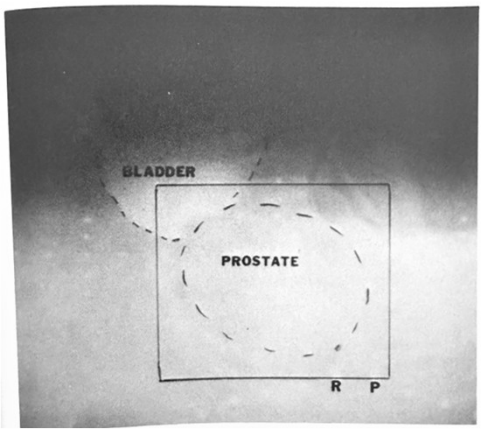
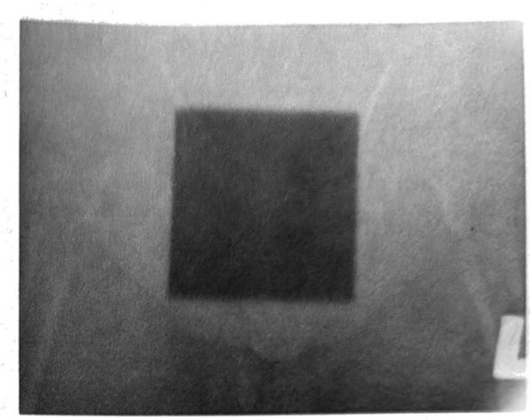


Lateral Simulation Film of the pelvis with contrast in the bladder with a rectal marker and prostate outlined

24

History: *Radiation Treatment Planning*

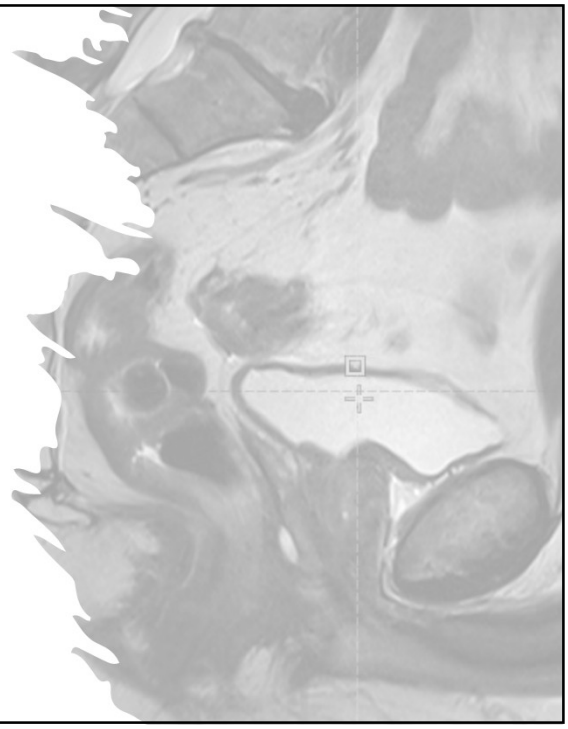
- External Beam Radiotherapy
  - Treatment Technique
    - Lateral pelvic x-ray with a rectal probe and contrast in the bladder is taken to localize the prostate
    - 270 degree anterior arc technique is used with an 8cm x 8cm field (no Cerrobend block needed)
  - Goal: to deliver a tumoricidal dose to the primary Prostate without exceeding bowel tolerance
  - Boost Dose: 30Gy in 15 fractions
    - Total Prostate Dose = 70Gy



Anterior Port Film of the 270 degree arc setup

25

Present Day Treatment Challenges



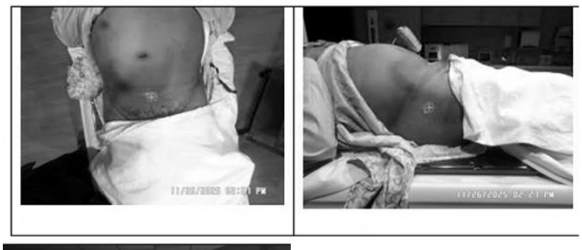
26

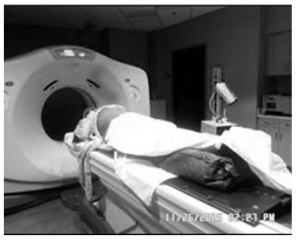
CT Simulation

- **Plan Quality Begins at Simulation:**
  - **High-quality prostate treatment planning starts with an optimal CT simulation — poor preparation at this stage can compromise the entire plan.**
- **Clear Patient Communication is Essential**
  - **Thorough instructions and good communication between the therapist and patient regarding bowel preparation and bladder filling are critical for achieving a reproducible setup and allowing dosimetry to meet the physician's desired dose constraints.**
- **Optimal Bladder Management**
  - **The bladder should be comfortably full and consistently reproducible. Overfilling is often unnecessary, as it may not represent the patient's typical daily bladder volume during treatment.**

27

CT Simulation



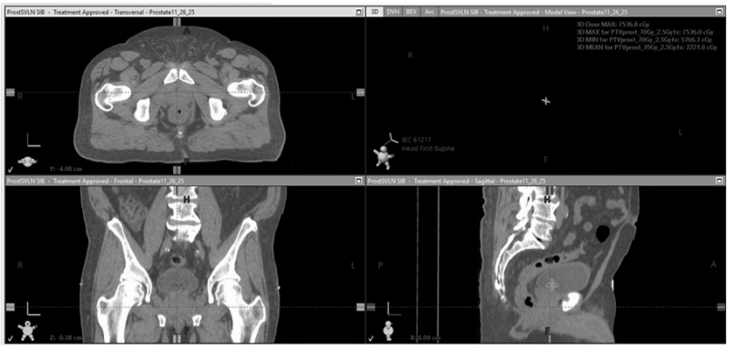


Patient is Supine with legs straight in lower vac loc, no shoes, hands folded on chest and head in a "F" Head Rest

28

CT Simulation

- **Covering Physician & Dosimetrist reviews every CT Scan in the CT Room (or remotely from computer) before the patient gets off the table**
  - many things have been discussed during this time and sometimes things are caught at this time – but every clinic is different



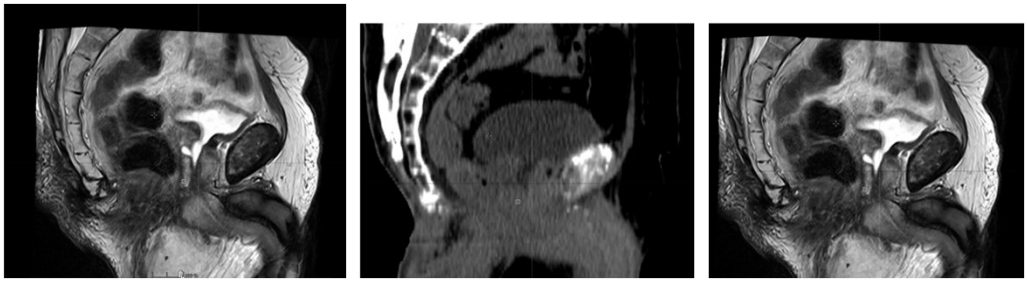
29

CT-MRI Registration Post-TURP

- **Altered Prostate Anatomy**
  - Post-TURP creates a central cavity or resection defect in the transition zone, which the bladder often fills, significantly distorting volume and making accurate image registration difficult.
- **Variable Bladder Filling**
  - Differences in bladder volume between CT simulation (often full) and diagnostic MRI (often empty) cause non-rigid deformation of the prostate bed and surrounding tissues, leading to poor alignment in Eclipse.
- **Unreproducible Distortion**
  - The bladder's ability to expand into the hollowed-out prostate creates highly variable anatomy between scans, reducing the reliability of the registration.
- **Impact on Planning**
  - These challenges can result in contouring uncertainty for the MD
- **Communication is Key**
  - Always notify the Radiation Oncologist in writing (via task note or email) when image registration is unreliable or challenging — verbal discussion is helpful as a follow-up, but written documentation ensures awareness before contouring begins.

30

CT-MRI Registration Post-TURP



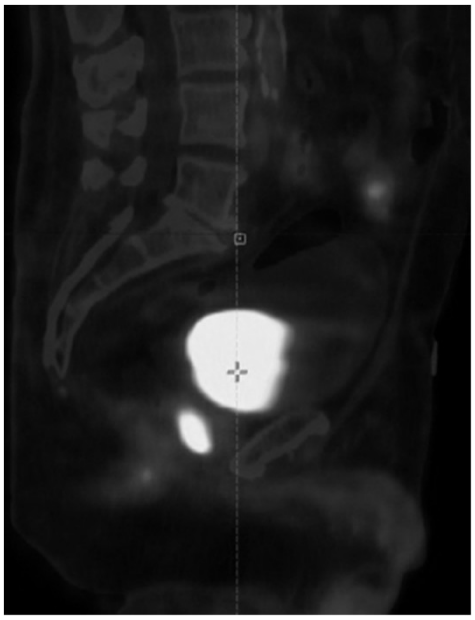
Post-TURP anatomy showed significant distortion with a large central surgical defect, which made reliable registration difficult.

Despite multiple attempts at alignment, I was not satisfied with the quality of the rigid registration — particularly around the central gland, base, and urethral region.

31

CT-PSMA PET Registration

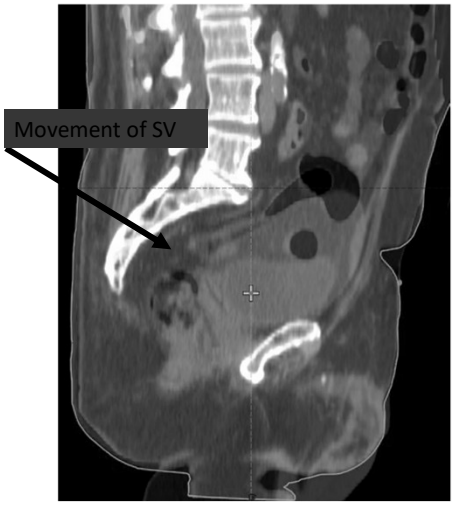
- **Rectal Filling Variability**
  - Differences in rectal distension (gas, stool, or emptiness) between diagnostic PET/CT and CT simulation can cause significant changes of the prostate and surrounding tissues
- **Seminal Vesicle Displacement**
  - The seminal vesicles are particularly mobile and sensitive to rectal filling changes, often shifting position by several millimeters, which complicates accurate image registration
- **Impact on Fusion Accuracy**
  - Poor alignment due to rectal changes can lead to uncertainty in target volume delineation for the MD and increased risk to nearby organs at risk, requiring careful review
- **Review PET Report First**
  - Always read the diagnostic PET report thoroughly before fusion to identify areas of PET avidity (e.g., prostate, nodes, or recurrence), allowing you to prioritize and optimize image registration in those critical regions



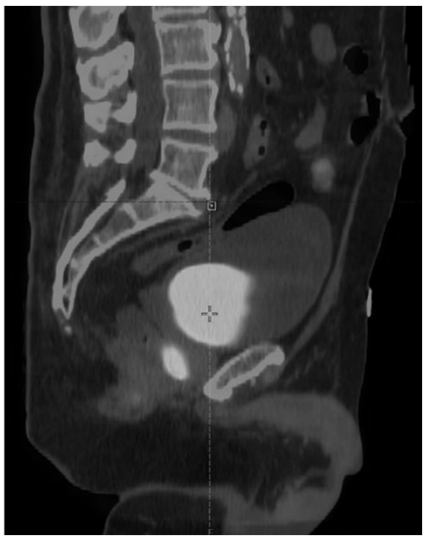
32

CT-PSMA PET Registration

Ridged Registration PSMA PET + CT Sim

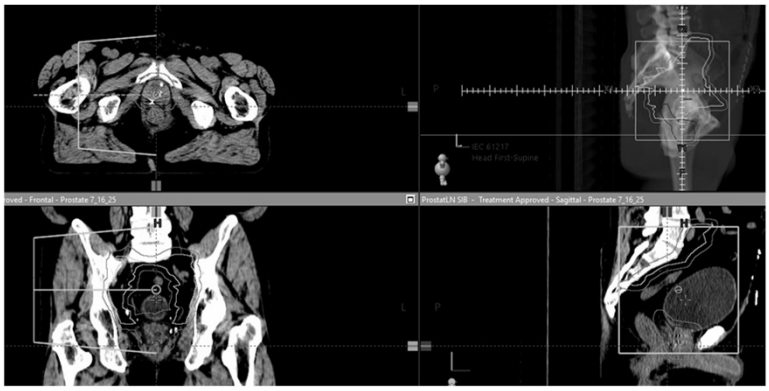


Deformed PET focused in the area of interest



33

Isocenter placement

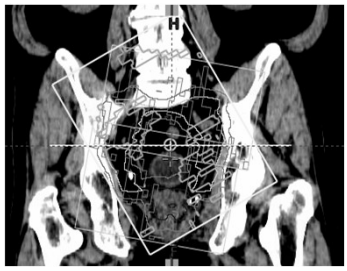
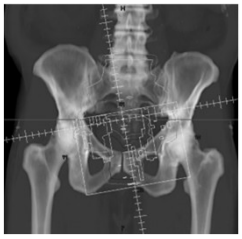
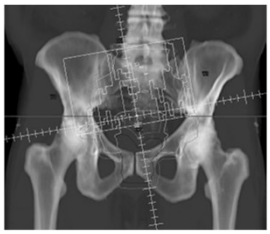
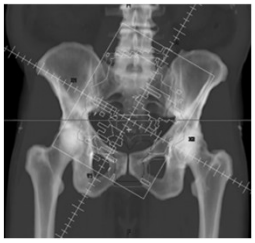
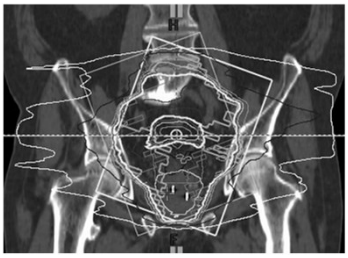
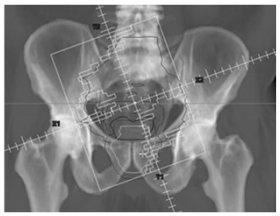
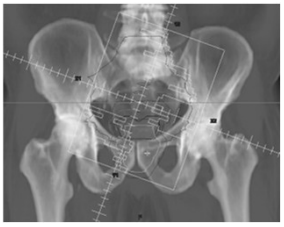


- Make sure that the whole prostate is included in the CBCT for Doctor review
- Laterally split the pubic symphysis

34

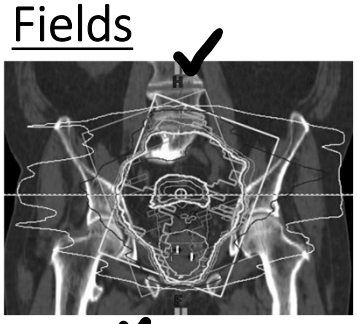
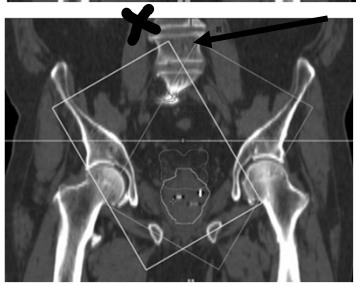
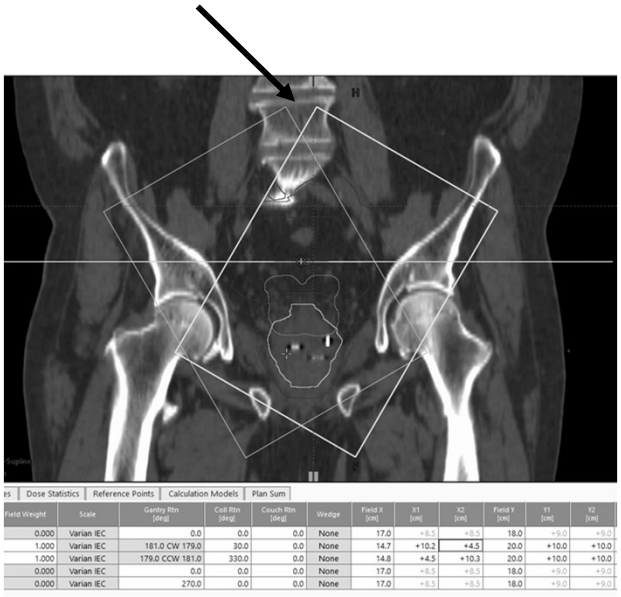
Fields

- 3 fields or 2 field are my go-to setup – depending on plan complexity;
  - size of target or demands of OAR Sparing

35

Fields

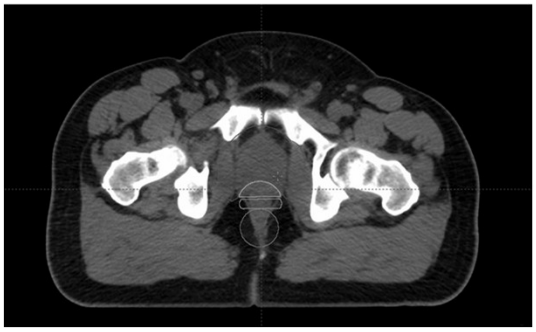
Dose Statistics	Reference Points	Calculation Models	Plan Sum

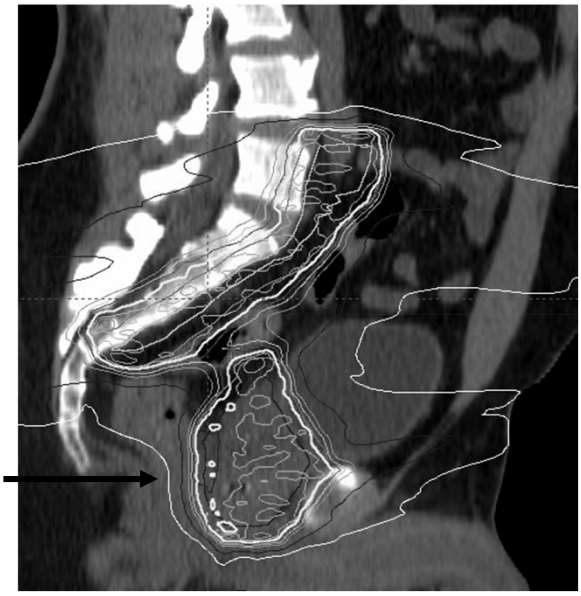
Field Weight	Scale	Gantry Rtn [deg]	Coll Rtn [deg]	Couch Rtn [deg]	Wedge	Field X [cm]	X1 [cm]	X2 [cm]	Field Y [cm]	Y1 [cm]	Y2 [cm]
0.000	Varian IEC	0.0	0.0	0.0	None	17.0	+8.5	+8.5	18.0	+9.0	+9.0
1.000	Varian IEC	181.0 CW 179.0	30.0	0.0	None	14.7	+10.2	+4.5	20.0	+10.0	+10.0
1.000	Varian IEC	179.0 CCW 181.0	330.0	0.0	None	14.8	+4.5	+10.3	20.0	+10.0	+10.0
0.000	Varian IEC	0.0	0.0	0.0	None	17.0	+8.5	+8.5	18.0	+9.0	+9.0
0.000	Varian IEC	270.0	0.0	0.0	None	17.0	+8.5	+8.5	18.0	+9.0	+9.0

36

Hot Spots

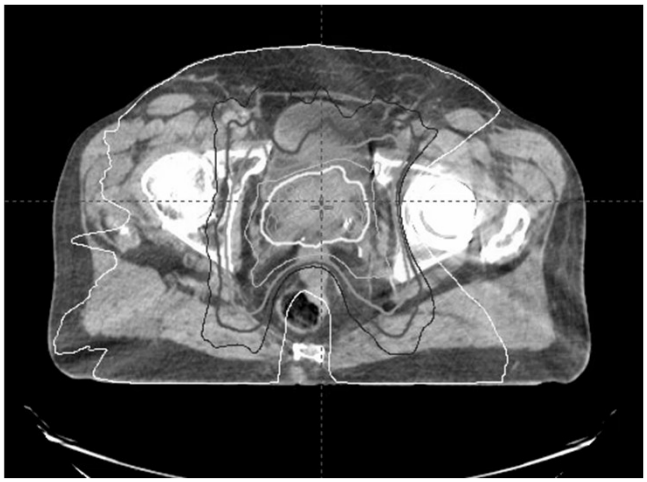
- Limit Hot spots to 103% posteriorly where the rectum abuts the prostate
- Try to split rectum with the 50% isodose line when able

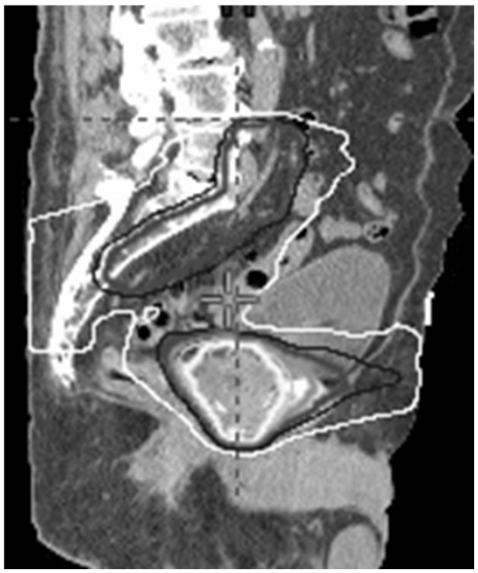




37

Prosthetic Hip Replacement

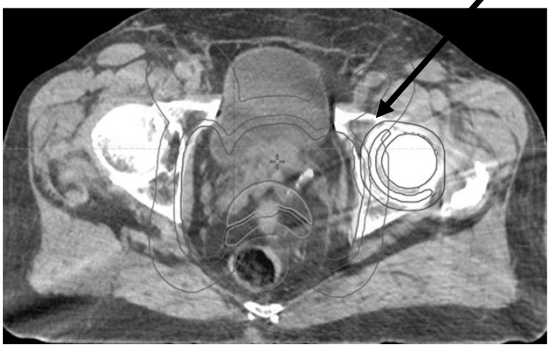


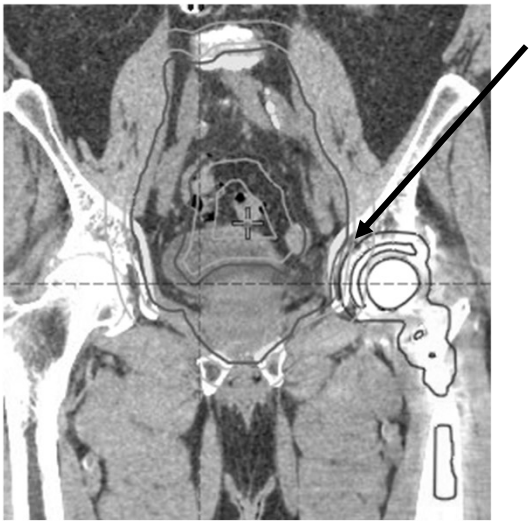


38

Prosthetic Hip Replacement

Create an opti PTV that is cropped away from the Hip by 0.5cm

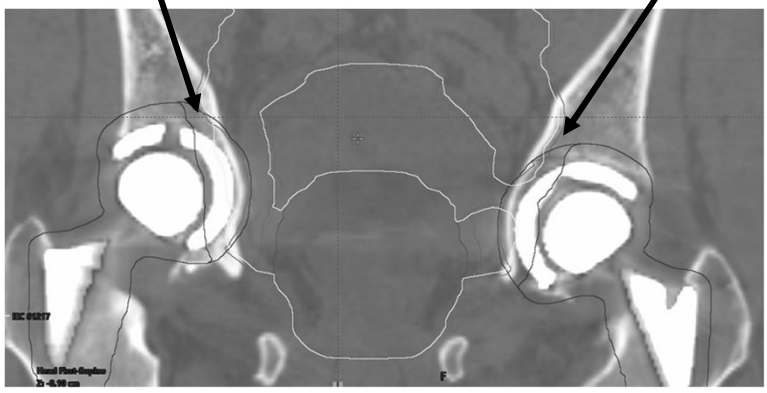


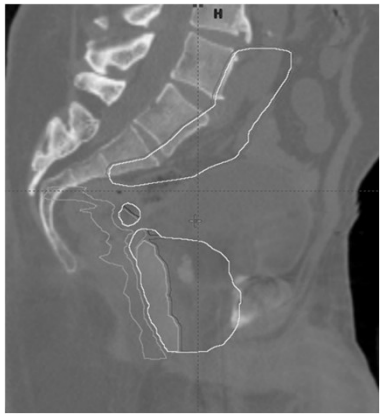


39

Bilateral Prosthetic Hip Replacement

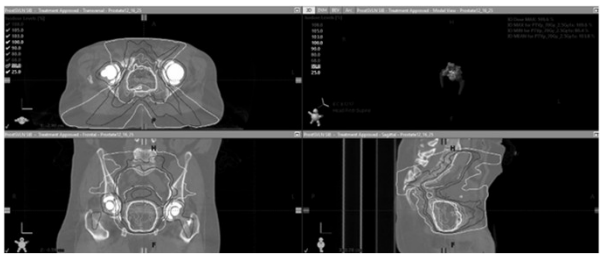
Create an Opti PTV that is cropped away from the Prosthetic Hip by 0.5cm (Pink contour is opti PTV + the Yellow is the MD's PTV)

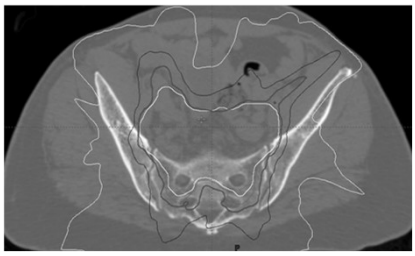


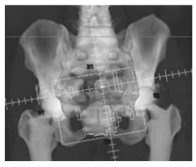


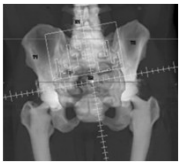
40

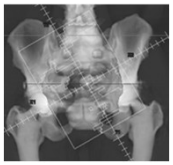
Bilateral Prosthetic Hip Replacement

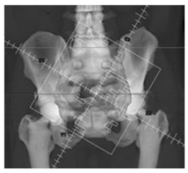










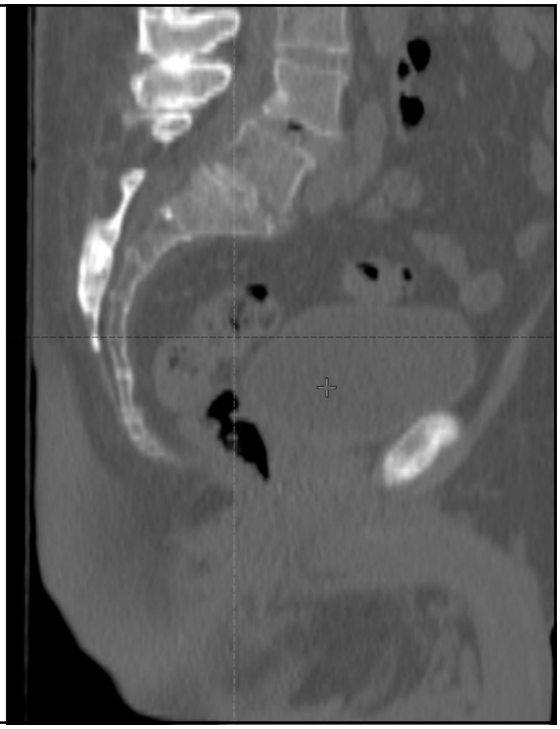


1 CW ProsPelvLN	Arc Therapy-I	NSMTB3573 - 6X	VMAT	2.621	Varian IEC	181.0 CW 179.0	280.0	0.0	None	10.1	+2.2	+7.9	18.0	+9.0	+9.0
2 CCW ProsPelvLN	Arc Therapy-I	NSMTB3573 - 6X	VMAT	1.557	Varian IEC	179.0 CCW 181.0	280.0	0.0	None	9.3	+10.8	-1.5	17.0	+8.5	+8.5
3 CW ProsPelvLN	Arc Therapy-I	NSMTB3573 - 6X	VMAT	1.489	Varian IEC	181.0 CW 179.0	30.0	0.0	None	16.5	+7.7	+8.8	19.7	+8.0	+11.7
4 CCW ProsPelvLN	Arc Therapy-I	NSMTB3573 - 6X	VMAT	1.239	Varian IEC	179.0 CCW 181.0	330.0	0.0	None	16.9	+9.0	+7.9	19.0	+8.0	+11.0

41

Gas in the Rectum

- Studies consistently show that rectal gas at simulation (if not overridden) lead to an over estimation of dose beyond the gas when the gas disappears.
- The Prostate (Target) gets underdosed and the Rectum gets overdosed
- Overriding the gas to water-equivalent density gives a more conservative and realistic calculation for the rectum.
  - especially in patients with significant rectal gas at simulation.



42

Gas in Rectum Analogy

FAST

SLOWED

Driving a car on a clear, empty highway with very little resistance. You calculate that you only need light pressure on the accelerator (low MU) to reach your destination at exactly the target speed (prescribed prostate dose).

On treatment day when the rectal gas is gone and the rectum is filled with soft tissue/fecal matter, You're driving on the same road, but now it's full of speed bumps and heavy traffic (dense tissue). You apply the **same light pressure on the accelerator** (same MU), but:

You also hit the speed bumps (rectal wall) much harder →

the rectum gets overdosed.

You don't fully reach your destination →

The Prostate (target) gets underdosed

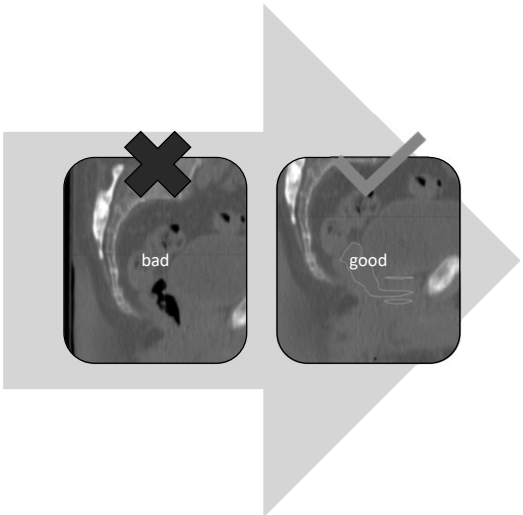
43

Gas in the Rectum

Always carefully review CT simulations for rectal gas — it displaces surrounding anatomy and affects dose calculation

Leaving gas as air leads to fewer MU in the plan, causing target underdose and rectal overdose when the gas resolves on treatment day

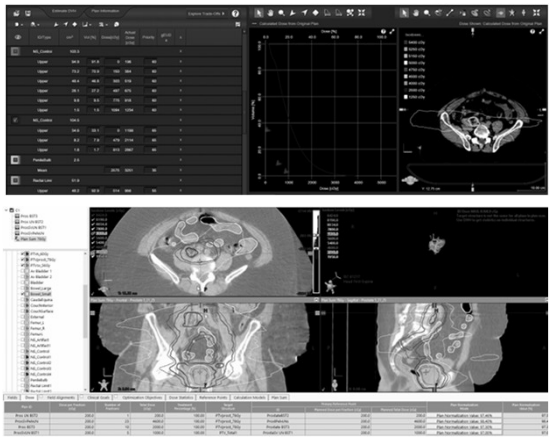
If significant rectal gas is present, routinely override the HU (air to water density) for a more robust and safer prostate VMAT plan



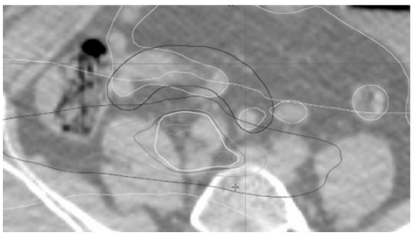
44

Case Study

T1cN1M0, PSA 36.18, Gleason 3+4=7



Rx	Total Dose	Fractions
Prophylactic Pelvic LNs	46	23
SV	56	5
Right PET+ Node	58	1
Prostate	78	10



45

Constraints

Priority	Variable ID	Structure Template	Structure Plan	Type	Prescription	Constraint	Goal	Plan Sum 78Gy	Comment
16		Femoral Heads	Femurs	OAR		D0.03cc ≤	5250cGy	5414.5cGy	(Verified by Nolet, Melissa CMD 6/3/2025 3:59:03 PM) REVIEWED AND APPROVED BY DR. AHMED ALI
17		Large Bowel	Bowel_Large	OAR		V6000cGy ≤	2%	0.004%	
18		Large Bowel	Bowel_Large	OAR		D0.03cc ≤	6250cGy	6196.5cGy	
19		Small Bowel Loops	Bowel_Small	OAR		V5000cGy ≤	10%	0.558%	
20		Small Bowel Loops	Bowel_Small	OAR		D0.03cc ≤	5200cGy	5678.9cGy	(Verified by Nolet, Melissa CMD 6/3/2025 3:59:04 PM) REVIEWED AND APPROVED BY DR. AHMED ALI
21		Penile Bulb	PenileBulb	OAR		V5000cGy ≤ (do not sacrifice target covg)	50%	47.681%	

Rx	Total Dose	Fractions
Prophylactic Pelvic LNs	46	23
SV	56	5
Right PET+ Node	58	1
Prostate	78	10

In this case, the small bowel received a Dmax of 56.78 Gy, which is above the more conservative 52 Gy limit many of us aim for.

I'd like to open this up for discussion: When you have a situation where small bowel is in close proximity to the target and you're forced to choose between ideal PTV coverage and keeping small bowel under 52–54 Gy — how do you typically approach this?
What techniques or strategies do you use to reduce small bowel dose while still maintaining acceptable target coverage?

46

Constraints

Prostate conventional
1.8-2Gy/Frx

Table 19 Prostate: conventionally fractionated regimens (1.8-2 Gy per fraction to 74-81 Gy)

Organ/target	Metric	Primary goal	Secondary goal	Deviation	Notes
Bladder[5,60–64]	V75Gy	≤25%		>25%	
	V70Gy	≤35%		>35%	
	V50Gy	≤50%		>50%	
Bowel_Large[65]	D0.035cc	≤62.5 Gy		>62.5 Gy	
	V60Gy	≤1%*		>1%*	
Bowel_Small[66,67]	D0.035cc	≤52.5 Gy	≤54 Gy	>54 Gy	
	V45Gy	≤150 cc	≤200 cc	>200 cc	
Femur_Head[68]	V50Gy	≤10%		>10%	
PenileBulb[5,60–63,67–69]	Mean	≤52.5 Gy		>52.5 Gy	PTV coverage should not be compromised
Rectum[4,4,67]	V75Gy	≤10%	≤15%	>15%	
	V70Gy	≤15%	≤25%	>25%	
	V40Gy	≤40% *	≤65%	>65%	
PTV	V100%	≥95%*	≥90%*	<90%*	
	D2%	≤110%*	≤115%*	>115%*	

Abbreviations: D = dose; PTV = planning target volume; V = volume.
*Panel consensus.

Practical Radiation Oncology® (2026) 16, 294–317

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Critical Review

Dose-Volume Histogram Compendium of Dose Constraints for Treatment Planning: An ASTRO Consensus Paper

47

Constraints

Prostate Moderately Hypo-Frac
3Gy/Fx to 60Gy

Table 20 Prostate: moderately hypofractionated 20 fraction regimen (3 Gy per fraction to 60 Gy)

Organ/target	Metric	Primary goal	Secondary goal	Deviation	Notes
Bladder[5,5,65,69]	V60Gy	≤5%	≤15%	>15%	
	V48Gy	≤25%		>25%	
	V40Gy	≤50%		>50%	
Bowel_Large[65]	D0.03cc	≤50 Gy		>50 Gy	
Bowel_Small[66,68]	D0.03cc	≤50 Gy*		>50 Gy*	
	V40Gy	≤17 cc	≤195 cc	>195 cc	
Femur_Head[68]	V40Gy	≤5%	≤50%	>50%	
PenileBulb[68]	V48Gy	≤10%		>10%	PTV coverage should not be compromised
Rectum[67,69,70]	V60Gy	≤0.01%	≤8%	>8%	
	V50Gy	≤22%		>22%	
	V30Gy	≤57%		>57%	
PTV	V100%	≥95%*	≥90%*	<90%*	
	D2%	≤110%*	≤115%*	>115%*	

Abbreviations: D = dose; PTV = planning target volume; V = volume.
*Panel consensus.

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48

Small Bowel

Prostate Moderately Hypo-Frac
2.5Gy/Fx to 70Gy

Table 21 Prostate: moderately hypofractionated 28 fraction regimen (2.5 Gy per fraction to 70 Gy)

Organ/target	Metric	Primary goal	Secondary goal	Deviation	Notes
Bladder[65,67-69,71]	V70Gy	≤10%	≤15%	>15%	
	V65Gy	≤15%	≤25%	>25%	
	V40Gy	≤35%	≤65%	>65%	
Bowel_Large[65,68]	D0.035cc	≤55 Gy	≤60 Gy	>60 Gy	
	V50Gy	≤1%*	>1%*		
Bowel_Small[67,71]	D0.035cc	≤52.5 Gy	≤54 Gy	>54 Gy	
	V40Gy	≤1%	>1%		
Femur_Head[71]	V40Gy	0%		>0%	
PenileBulb[71]	Mean	<50 Gy		≥50 Gy	PTV coverage should not be compromised
Rectum[67-69,71]	V70Gy	≤5%	≤10%	>10%	
	V65Gy	≤10%		>10%	
	V40Gy	≤35%		>35%	
PTV	V100%	≥95%*	≥90%*	<90%*	
	D2%	≤110%*	≤115%*	>115%*	

Abbreviations: D = dose; PTV = planning target volume; V = volume.
*Panel consensus.

Practical Radiation Oncology® (2026) 16, 294–317

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49

Constraints

Prostate Moderately Hypo-Frac
3Gy/Fx to 60Gy

Table 21 Prostate: moderately hypofractionated 28 fraction regimen (2.5 Gy per fraction to 70 Gy)

Organ/target	Metric	Primary goal	Secondary goal	Deviation	Notes
Bladder[65,67-69,71]	V70Gy	≤10%	≤15%	>15%	
	V65Gy	≤15%	≤25%	>25%	
	V40Gy	≤35%	≤65%	>65%	
Bowel_Large[65,68]	D0.035cc	≤55 Gy	≤60 Gy	>60 Gy	
	V50Gy	≤1%*	>1%*		
Bowel_Small[67,71]	D0.035cc	≤52.5 Gy	≤54 Gy	>54 Gy	
	V40Gy	≤1%	>1%		
Femur_Head[71]	V40Gy	0%		>0%	
PenileBulb[71]	Mean	<50 Gy		≥50 Gy	PTV coverage should not be compromised
Rectum[67-69,71]	V70Gy	≤5%	≤10%	>10%	
	V65Gy	≤10%		>10%	
	V40Gy	≤35%		>35%	
PTV	V100%	≥95%*	≥90%*	<90%*	
	D2%	≤110%*	≤115%*	>115%*	

Abbreviations: D = dose; PTV = planning target volume; V = volume.
*Panel consensus.

Practical Radiation Oncology® (2026) 16, 294–317

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Critical Review

Dose-Volume Histogram Compendium of Dose Constraints for Treatment Planning: An ASTRO Consensus Paper

50

Constraints

Post-Opt Prostate: Conventional
1.8-2Gy/Fx to 64-72Gy

Prostate ultrahypo-Frac
7.25-8Gy/Fx to 36.25-40Gy

Table 22 Postoperative prostate: conventionally fractionated regimens (1.8-2 Gy per fraction to 64-72 Gy)

Organ/target	Metric	Primary goal	Secondary goal	Deviation	Notes
Bladder[72]	V65Gy	<50%	≤57.5%	>57.5%*	Bladder − CTVp
	V40Gy	≤70%	≤77%	>77%	
Bowel_Large	D0.03cc	≤62.5 Gy*		>62.5 Gy*	
	V60Gy	≤1%*		>1%*	
Bowel_Small[66,73]	V60Gy	≤0.1 cc		>0.1 cc	
	V45Gy	≤150 cc	≤200 cc	>200 cc	
Femur_Head[66]	V50Gy	≤10%	≤15%	>15%	
PenileBulb[73]	Mean	≤52.5 Gy		>52.5 Gy	
Rectum[72]	V65Gy	≤35%	≤45%	>45%*	
	V40Gy	≤55%	≤65%	>65%*	
PTV (Prostate bed)	V100%	≥95%*	≥90%*	<90%*	
	D2%	≤110%*	≤115%*	>115%*	

Abbreviations: CTVp = primary clinical target volume; D = dose; PTV = planning target volume; V = volume.
*Panel consensus.

Table 23 Prostate: ultrahypofractionated 5 fraction regimens (7.25-8 Gy per fraction to 36.25-40 Gy)

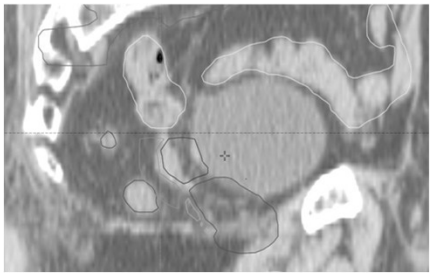
Organ/target	Metric	Primary goal	Secondary goal	Deviation	Notes
Bladder[64,68]	V37Gy	<5 cc	<20 cc	≥20 cc	
	V18.1Gy	<40%		≥40%	
Bowel_Large[68]	D0.03cc	≤30 Gy		>30 Gy*	
Bowel_Small[64,68,74]	V30Gy	≤0.03 cc	≤1 cc	>1 cc*	
	V18.1Gy	<5 cc		≥5 cc	
Femur_Head[64]	V14.5Gy	<5%		≥5%	
PenileBulb[62,74,75]	D0.03cc	≤36.25 Gy	>36.25 Gy		PTV coverage should not be compromised
	V29.5Gy	<50%	≥50%		
Rectum[64,68,76]	V36Gy	<1 cc	<3 cc	≥3 cc	
	V29Gy	<20%		≥20%	
	V18.1Gy	<50%		≥50%	
Urethra[64]	V42Gy	<50%		≥50%	
PTV[62,74,75]	V100%	≥95%*		<95%*	
	D0.03cc	≤120%*		>120%*	Robotic/ablative
	D0.03cc	≤107%		>107%	Linac based

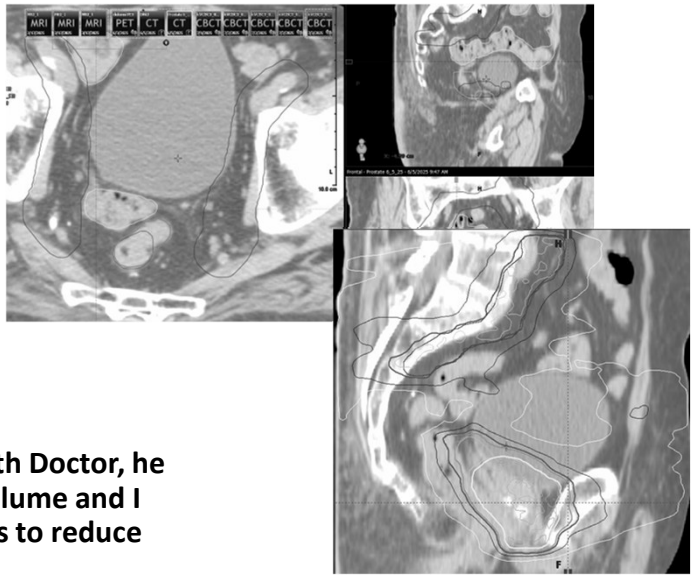
Abbreviations: D = dose; Linac = linear accelerator; PTV = planning target volume; V = volume.
*Panel consensus.

51

Small Bowel

Prostate, SV & Nodes SIB

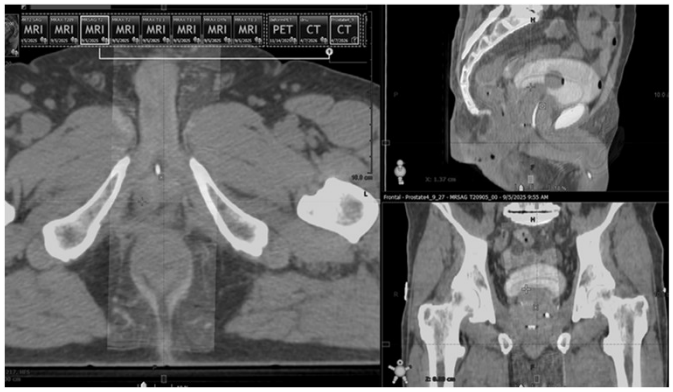




After discussion with Doctor, he amended the SV volume and I used PRV structures to reduce dose in that area

52

Need Help finding the Urethra?



We're using the Foley that's already in from fiducial placement during CT sim and fusing it with the MRI. It makes the urethra much easier to see and contour, so we feel more confident sparing it in our SBRT and FLAME cases.

- Contour the urethra in SBRT and FLAME prostate planning for these reasons:
  - To limit dose and reduce urinary toxicity such as frequency, urgency, or obstruction.
  - To optimize dose distribution and spare the urethra while covering the prostate.
  - To safely deliver focal high-dose boost to the tumor in FLAME without excess urethral damage.

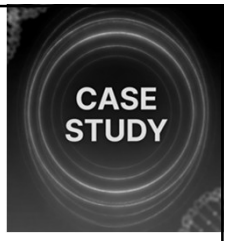
Doses: SBRT uses 36.25Gy in 5 fractions; FLAME uses 77 Gy in 35 fractions plus integrated boost to the MRI-visible lesion.

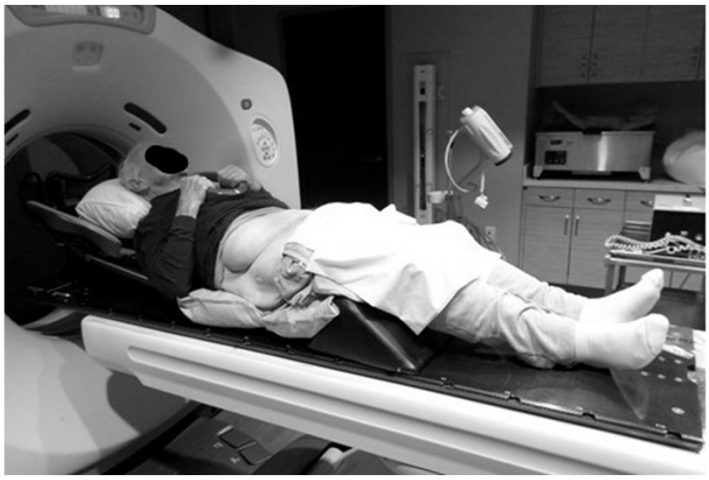
53

Replanning Realities

54

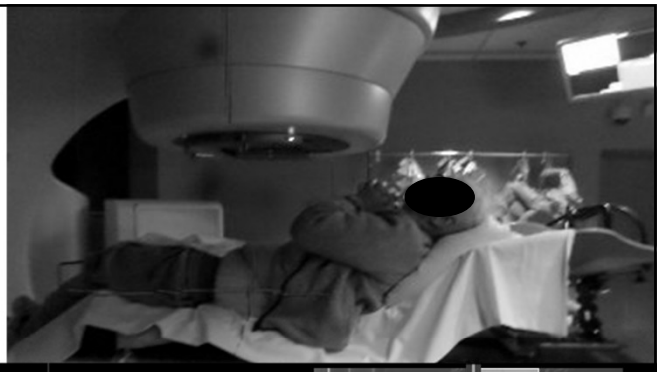
Replanning Realities

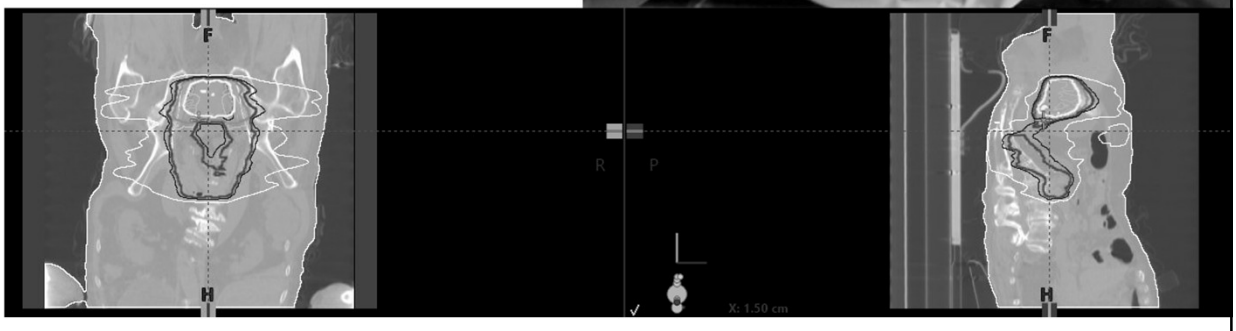




55

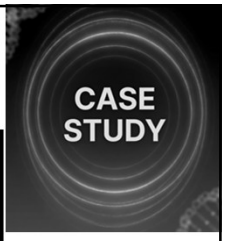
Replanning Realities

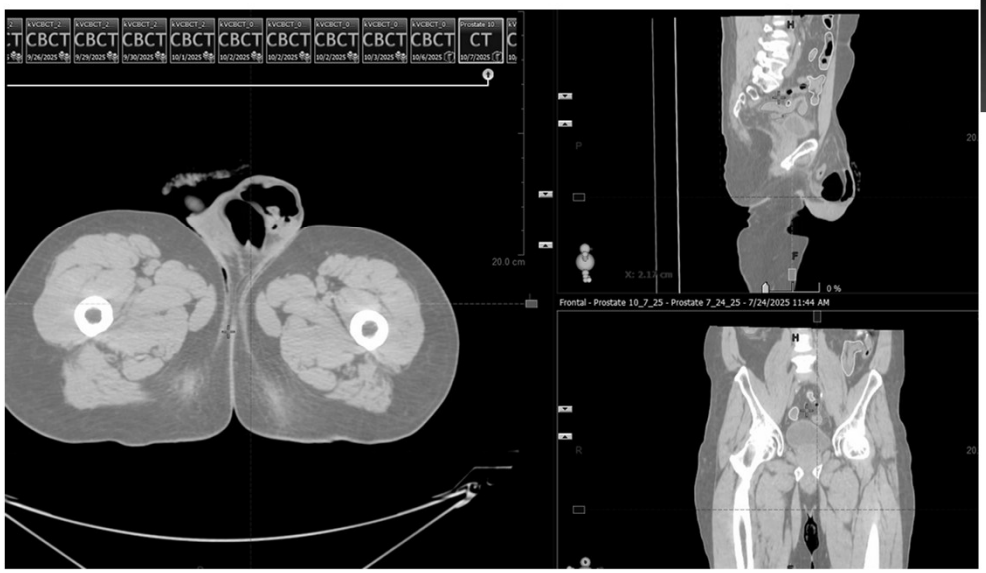




56

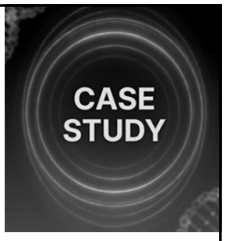
Learn from My Mistakes

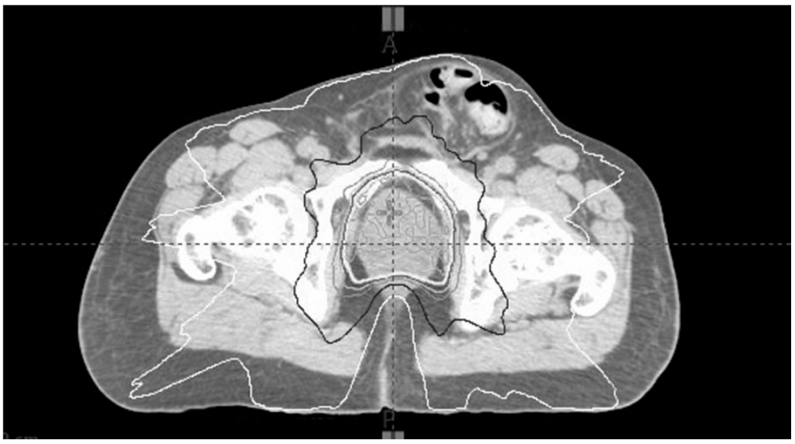




57

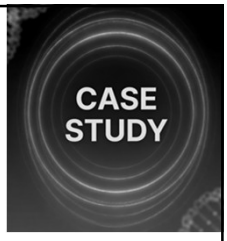
Learn from My Mistakes

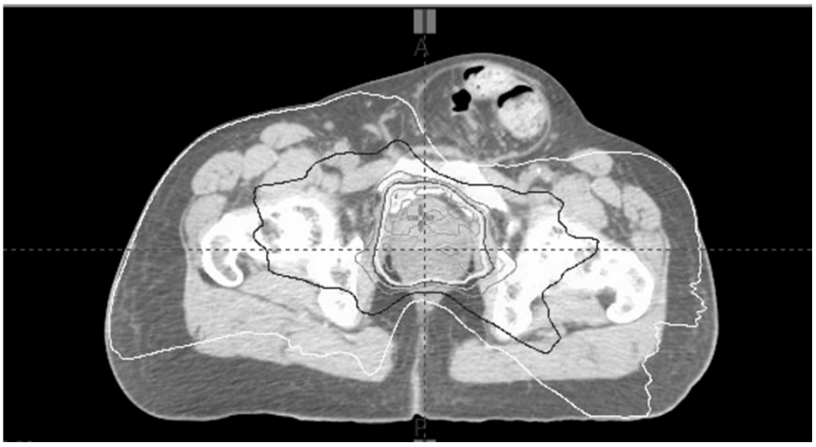




58

Learn from My Mistakes





59

Future of Prostate Treatment

Next 5 Years

- Wide adoption of: PSMA-PET, SBRT/HDR optimization, & De-escalating duration of ADT course

Next 10 Years

- AI-driven stratification, focal therapy expansion

Next 20 Years

- Precision curative approaches, advanced theranostics, prevention focus

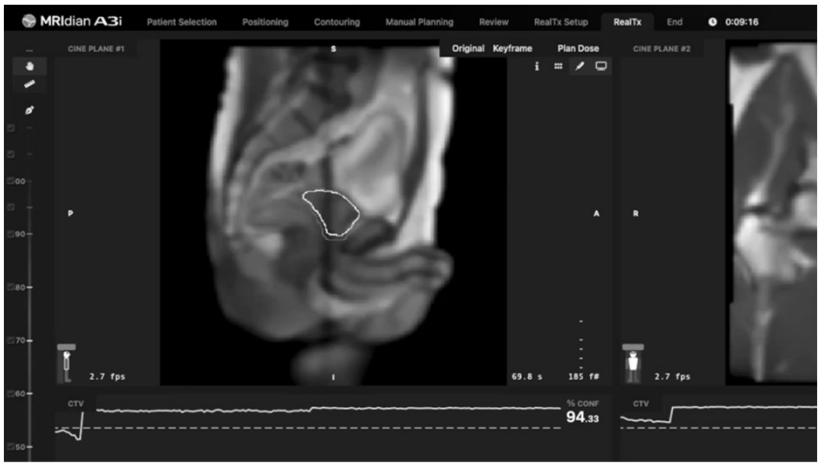
Driven by: PSMA imaging, genomics (Decipher Score), AI, and theranostics

Goal: Higher cure rates with reduced toxicity and better quality of life

Relevance to Dosimetry: Adaptive planning, PSMA-guided volumes, AI optimization

60

A Glimpse into the Future, Now: MRIdian



61

62