

ARRO Case: HDR Prostate Brachytherapy

Karna Sura, MD (PGY-5)

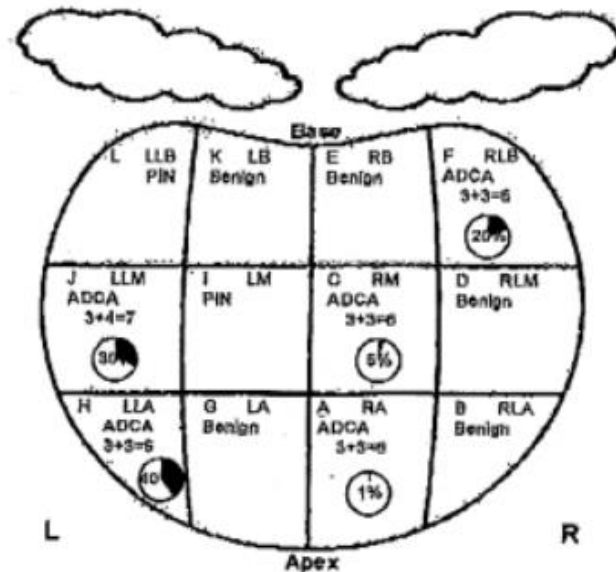
Faculty Advisor: Sirisha Nandalur, MD

Department of Radiation Oncology

Beaumont Health

Case Presentation

- 67 year old male presented with an elevated PSA at 3.55 ng/mL
- Found to have no evidence of abnormalities on DRE
- Underwent prostate biopsy



Case presentation continued

- Discussed various treatment options including:
 - Active surveillance
 - Radical prostatectomy
 - External beam radiation
 - HDR prostate brachytherapy as a monotherapy
 - Other options include LDR brachytherapy and SBRT
- Patient wanted to proceed with brachytherapy

Brief History of Prostate Brachytherapy

- 1917 – Barringer inserted radium needles transperineally in the prostate
- 1952 – Flocks et al. injected radioactive gold solution into prostate cancer
- 1972 – Willet Whitmore described an open implant technique using ^{125}I
- 1983 – H. Holm described technique of implanting the prostate with radioactive seeds

Radiobiology behind prostate brachytherapy

- Prostate tumors have small fraction of cycling cells and possibly a low α/β ratio
- A meta-analysis of 20+ studies has estimated the α/β ratio between 1-4 Gy with a mean of 2.7 Gy
- Thus, hypofractionation might be more effective for prostate cancer

Patient history

- Urologic history
 - Prior transurethral or open resection of the prostate or other surgery on the urethra
 - Prior procedure for BPH
 - Medication for urinary obstructive symptoms
 - Erectile function
- Prior diagnosis of cancer, especially rectal or bladder cancer
- Prior pelvic radiotherapy, surgery, or fracture
- Inflammatory bowel disease
- Connective tissue disorder
- Documentation of the IPSS
- Documentation of erectile function, International Index of Erectile function score

Work-up

- Prostate biopsy within the last 12 months
- PSA
- DRE
- Prostate volume
- Can tolerate extended dorsal lithotomy position
- Suitability for anesthesia

Indications for prostate brachytherapy

Patient factors

- Life expectancy > 5 year
- IPSS < 15
- Prostate volume < 60 cc
- No defect with previous TURP
- Minimal pubic arch interference

Tumor factors

- Monotherapy
 - T1-T2b
 - Gleason ≤ 7 (3+4)
 - PSA ≤ 15
- Boost
 - $\geq T2c$
 - Gleason ≥ 7
 - PSA ≥ 10

Contraindications to prostate brachytherapy

Absolute

- Limited life expectancy
- Unacceptable operative risk
- Distant metastases
- Absence of a rectum or rectal fistula
- Large TURP defect
- Ataxia telangiectasia

Relative

- High IPSS (>20)
- History of prior pelvic RT
- TURP defect
- Large median lobe
- Gland size > 60 cc
- Inflammatory bowel disease
 - Want asymptomatic and have not required medical management for greater than 6 months

Pre-brachytherapy prostate ultrasound

- Goal: To determine if patient is a candidate for prostate brachytherapy
- Determine prostate size and length
- Determine if the patient has any arch interference
- Determine if there is any other reasons patient cannot tolerate brachytherapy

HDR technique

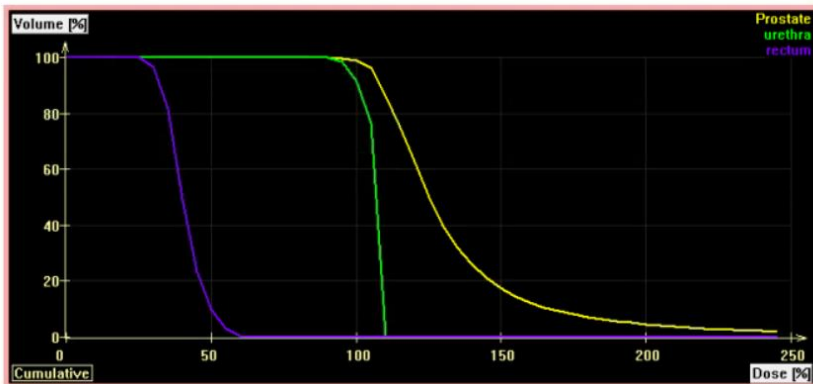
- Patient is placed under spinal or general anesthetic
- Positioned in supine in lithotomy position
- Contrast is placed in the bladder
- Urethra can be identified using Mucogel and/or foley.
 - Issue with foley is potential changes in the prostate anatomy
- Needles are placed in the prostate at regular intervals
- For CT-based planning, images should be contiguous and no more than 3 mm thick in axial plane. Should extend at least 9 mm above and below the target volume
- Patient received 1350 cGy x 2 fractions separated by 2 weeks
- Patients are discharged same day after regaining urinary function

HDR constraints

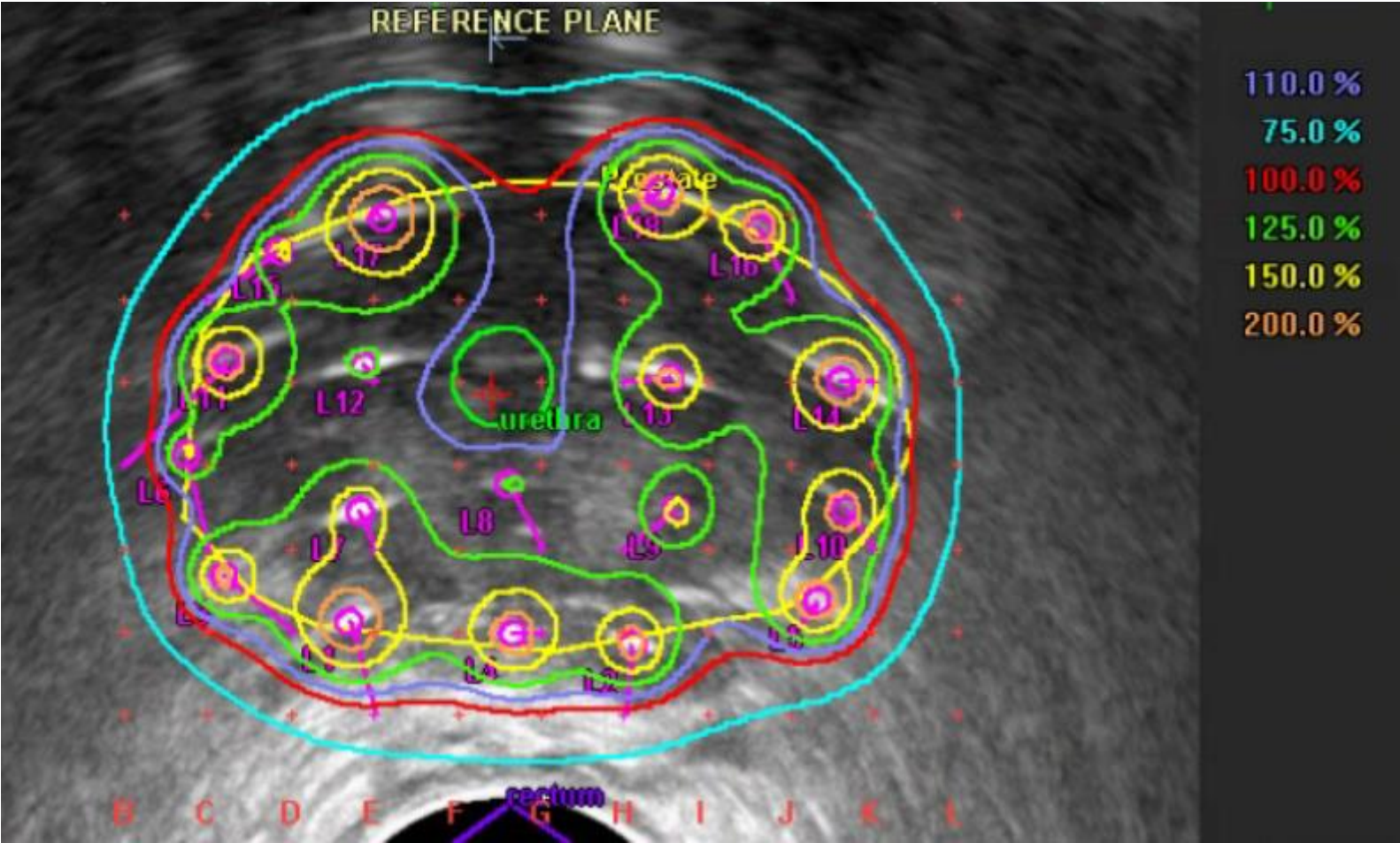
Organ	Volume	Constraint
CTV	V100	>95%
CTV	V125	50-60%
CTV	V150	<35%
Rectum	D2cc	<70%
Rectum	V75	<1 cc
Bladder	V75	<1 cc
Urethra	V115	<1 cc

Case Presentation - DVH

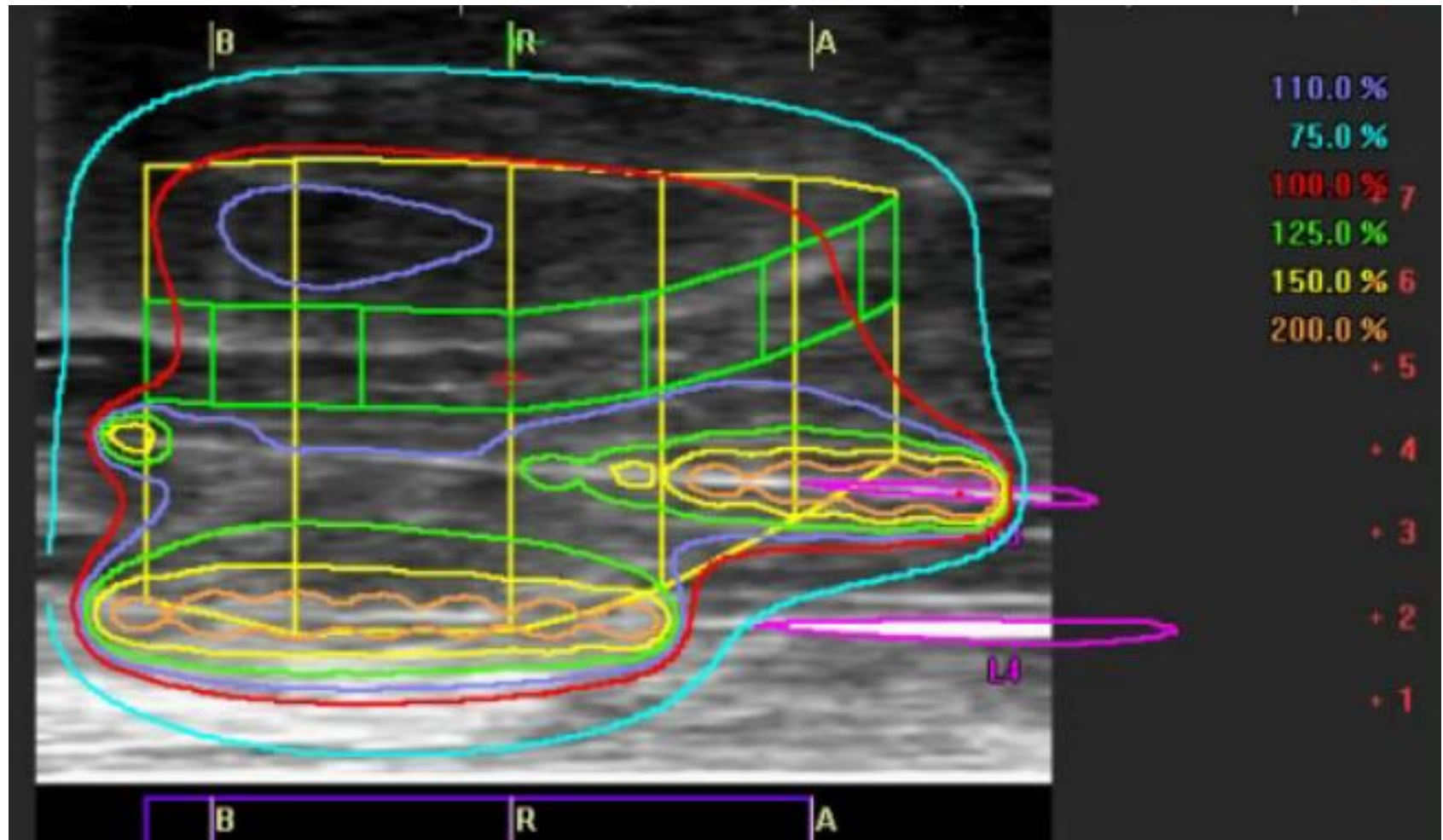
- Prostate
 - V100 = 99.02%
 - V125 = 50.04%
 - V150 = 17.59%
 - V200 = 4.59%
- Urethra
 - V100 = 91.48%
 - V110 = 9.45%
- Rectum
 - V75 = 0%



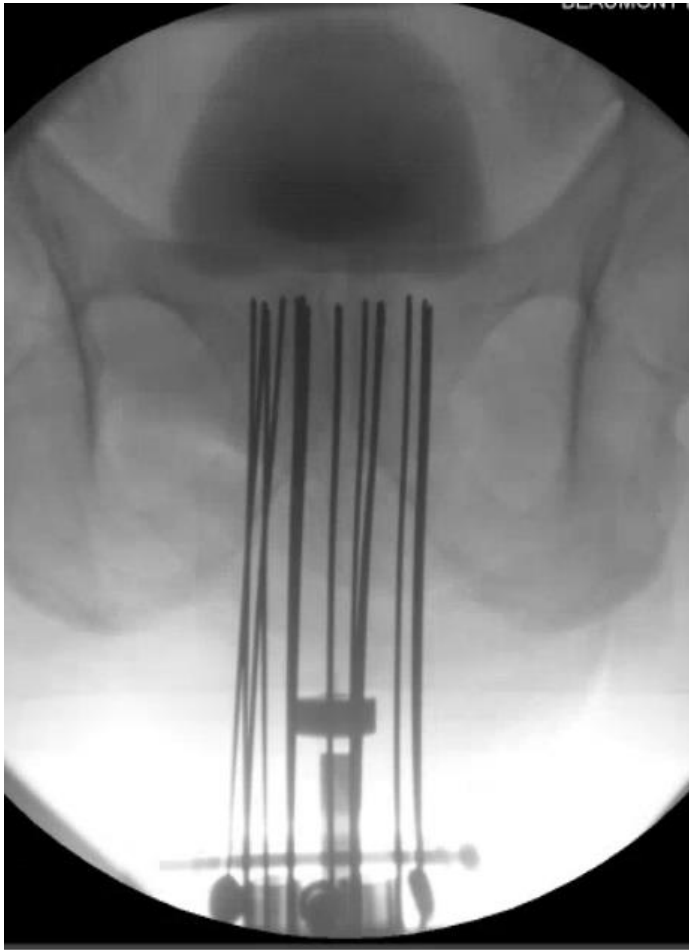
Case Presentation – Isodose (axial)



Case Presentation – Isodose (sagittal)



Case Presentation – X-Ray



- Pre-treatment x-ray showing needles in the prostate in the same position

References

- 1. Denmeade SR, Isaacs JT. A history of prostate cancer treatment. Nature reviews. Cancer. 2002;2: 389-396.
- 2. Holm HH. The history of interstitial brachytherapy of prostatic cancer. Semin Surg Oncol. 1997;13: 431-437.
- 3. Yamada Y, Rogers L, Demanes DJ, et al. American Brachytherapy Society consensus guidelines for high-dose-rate prostate brachytherapy. Brachytherapy. 2012;11: 20-32.