### **Brachytherapy in Early Stage Prostate Cancer**



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# **Learning Objectives**

 To select patients with early stage prostate cancer for brachytherapy

• To learn the skill of interstitial brachytherapy

<u>Ultimate aim</u>: To motivate you for prostate brachytherapy

# **Early Stage Prostate Cancer**

- Organ confined disease
- Carries excellent prognosis
- Multiple options
  - -Watchful waiting or Active survellence

-Radical Prostatectomy

-Radiation Therapy : EBRT or Brachytherapy

### **Brachytherapy for Carcinoma Prostate**

• As monotherapy : for low risk patients

• As Boost : for intermediate and high risk pts

• As salvage therapy : for recurrent cases

# Why Brachytherapy ?

- Conformal treatment
- Very high dose (~150 Gy)
- Short course therapy
- Excellent local control
- Better quality of life
- Preservation of sexual function
- Cost effective

# Brachy the most conformal technique for dose escalation



#### **Brachytherapy the best for prostate...**

# **Prostate Brachytherapy is simple**

- Anatomically accessible
- TRUS guidance
- Small tissue
- Silent malignancy



# **Types of Brachytherapy**

• High dose Rate (HDR) Brachytherapy

 Low dose Rate (LDR) Brachytherapy or Seed Brachytherapy

# **HDR Brachytherapy: Indications**

### Monotherapy

• Low and intermediate risk (select)

### **Boost (combined with EBRT)**

- any T with N0 M0
- any PSA
- any Gleason-Score



BRACHYTHERAPY

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# American Brachytherapy Society consensus guidelines for high-dose-rate prostate brachytherapy

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Task Group/Practice Parameter

#### American Brachytherapy Society Task Group Report: Combination of brachytherapy and external beam radiation for high-risk prostate cancer

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### HDR Brachytherapy: contraindications

### Absolute

- 1. Preexisting rectal fistula,
- 2. Medically unsuited for anesthesia, and
- 3.No proof of malignancy.

### Relative

High pubic arch, Median lobe hypertrophy, or any other technical/dosimetric contra-indication (e.g. improper lithotomy)

### **Patient Preparation**



#### Spinal anesthesia

#### Lithotomy position

#### Foley catheter (Tri-lumen)

# Procedure



#### USG with TRUS probe

#### TEMPLATE









### Let the Foley's be high up to avoid balloon rupture



### LP Needle to Decide the Position of Template



#### Template fixation







# **TRUS Imaging**



Fixation of probe and template on the stepper

### **Needle insertion using USG guidance**







#### **Dose Colour wash**

#### **3D Reconstruction**



#### DVH



#### Treatment



### **Phantom Trials to Streamline Workflow Logistics**













Continuous TRUS-image-recording with online transfer to the real-time planning system



Definition of base plane, reference plane and apex

# Prostate Steps contd..

- Needle insertion as per preplan
- Repeat 3D USG
- Catheter reconstruction and contouring
- Final plan and evaluation
- Connect for treatment
- Implant removal
- Bladder irrigation for hemostasis



### Dosimetry





85.0 % 100.0 % 125.0 % 150.0 % 200.0 % 250.0 % 300.0 %



### Pre-implant & Post Implant Care

- Antibiotic on the morning of implant
- Complete bowel preparation with PEGLEC the day prior
- Part preparation
- Post procedure Anti inflammatory, antibiotics & alpha blockers
- Bladder irrigation with normal saline till hematuria subsides
- Foleys out the next day

Current	dose	fractionation	schedules
	ALC: NOT THE		

Institution	Dose fractionation	Bladder	Urethra	Rectum
MSKCC	Boost 7Gyx3 Mono 9.5Gyx4 Salvage 8Gyx4		<120% prescription	D <sub>2 cc</sub> < 70%
UCSF	Boost 15Gyx1 Mono 10.5Gyx3 Salvage 8Gyx4*	V <sub>75</sub> < 1 cc	$V_{125} < 1 \text{ cc}, V_{150} = 0 \text{ cc}$ *(dose tunnel whenever possible)	V <sub>75</sub> < 1 cc
WBH	Boost 10.5Gyx2 Mono 4 × 9.5 Gy (historical) 12–13.5Gyx2 (current) Salvage 7Gyx4 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 6Gyx2 ×2 implants	<80% of Rx	<125% of prescription	<80% of Rx to outer wall
GW	Boost 6.5Gyx3 Mono two sessions of 6.5Gyx3	<100% prescription	<110% prescription	mucosa <60%, outer wall <100%
Toronto	Boost 15Gyx1	n/a	D <sub>10</sub> < 118% Max < 125%	$V_{80} < 0.5 \text{ cc}$
UCLA-CET	Boost 6Gyx4 Mono7.25Gyx6	90–100% wall 80% balloon	120% combo 105% any TUR 110% mono	Rectal wall 80% Rectal wall 80–85%

Seed Brachytherapy in Carcinoma Prostate

### Permanent prostate implant

- Mainly monotherapy
- May be used as boost
- Salvage of recurrent tumors





### **Patient selection**

### I-125/Pb-103 Mono-therapy:

- cT1 ~ T2b
- PSA < 10
- GS: 2 6
- T1-T2 / GS < 7 / PSA < 10,



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American Brachytherapy Society consensus guidelines for transrectal ultrasound-guided permanent prostate brachytherapy
Brian J. Davis<sup>1,\*</sup>, Eric M. Horwitz<sup>2</sup>, W. Robert Lee<sup>3</sup>, Juanita M. Crook<sup>4</sup>, Richard G. Stock<sup>5</sup>, Gregory S. Merrick<sup>6</sup>, Wayne M. Butler<sup>6</sup>, Peter D. Grimm<sup>7</sup>, Nelson N. Stone<sup>8</sup>, Louis Potters<sup>9</sup>, Anthony L. Zietman<sup>10</sup>, Michael J. Zelefsky<sup>11</sup>

Suggested treatment schema for low-, intermediate-, and high-risk disease for PPB

Risk group per NCCN	Brachytherapy alone?	Combined with EBRT?	Combined with androgen deprivation?
Low	Yes	Not favored	Not favored
Intermediate	Optional	Optional	Optional
High	No	Yes	Favored

### Absolute contraindications to TRUS-guided PPB

- Limited life expectancy
- Unacceptable operative risks
- Distant metastases
- Absence of rectum such that TRUS guidance is precluded
- Large TURP defects, which preclude seed placement and acceptable radiation dosimetry
- Ataxia telangiectasia

#### Radionuclides for permanent prostate brachytherapy

	Half-life (d)	Average energy (keV)	Year introduced	Typical monotherapy seed strength	
Radionuclide				(mCi)	(U)
<sup>125</sup> I	59.4	28.4	1965	0.3-0.6	0.4-0.8
<sup>103</sup> Pd	17.0	20.7	1986	1.1-2.2	1.4-2.8
<sup>131</sup> Cs	9.7	30.4	2004	2.5-3.9	1.6-2.5

#### Prescription doses to the planning target volume

1	2	5	T

Monotherapy Combination EBRT PPB dose

<sup>103</sup>Pd Monotherapy Combination EBRT PPB dose

140-160 Gy  $41.4 - 50.4 \text{ Gy} (1.8 \text{ Gy/d}^{a})$ 108-110 Gy 110-125 Gy  $41.4 - 50.4 \text{ Gy} (1.8 \text{ Gy/d}^{a})$ 90-100 Gy

# **Implant procedure**





Planning-TRUS guided volume study—computer preplan Brachytherapy procedure-TRUS guided trans perineal needle-.. peripheral loading.. seeds placed along the tract from base to apex.

Post implant evaluation -by CT scan



![](_page_39_Picture_0.jpeg)

*Prostate*:  $D_{90}$  (in Gy and percent)  $V_{100}$  and  $V_{150}$  (in percent)

Urethra:  $UV_{150}$  (in volume)  $UV_5$ ,  $UV_{30}$  (percent)

*Rectum:*  $RV_{100}$  (in volume)

Aim to keep UV5<150% and UV30<125% in the preplan

![](_page_41_Figure_0.jpeg)

![](_page_42_Figure_0.jpeg)

![](_page_43_Figure_0.jpeg)

<sup>\*</sup>Zelefsky, Leibel, et al. IJROBP 41:491-500, 1998.

### **Acute Symptoms**

- Dysuria (often)
- Hematuria (common)
- Perineal hematoma (significant < 3 %)</li>
- Obstruction (5-12%)
- Perineal Pain (< 5%)
- Diarrhea (< 10%)

### **Delayed Complications**

- Chronic cystitis (3-7 %)
- Incontinence (1% for non-TURP, 25-42% for TURP)
- Rectal ulceration (< 1 %)</li>
- Urethral necrosis (< 1 %)</li>
- Erectile dysfunction (> 70y/o, 20-25%; < 70y/o, 10-15%)</li>

# Conclusion

- Brachytherapy can be used as
  - monotherapy for low risk patients
  - boost for intermediate/high risk patients
- Provides excellent local control
- Preservation of sexual function
- Cost effective treatment
- Indian centers should adopt the practice of prostate brachytherapy

# THANK YOU