

**Prostate Brachytherapy  
Mick Applicator  
Image Guided Techniques  
Thomas G. Shanahan, M.D.**



Clinical Associate Professor  
Urology and Radiation Oncology  
Southern Illinois University  
School of Medicine  
Memorial Medical Center  
Springfield, Illinois

# PROSTATE BRACHYTHERAPY

Preloaded Needles

- **Preplan Technique**

- Mick Applicator
- **Preplan Technique**
- **Hybrid Interactive**
- **Interactive**
- **Intra-op Planning**

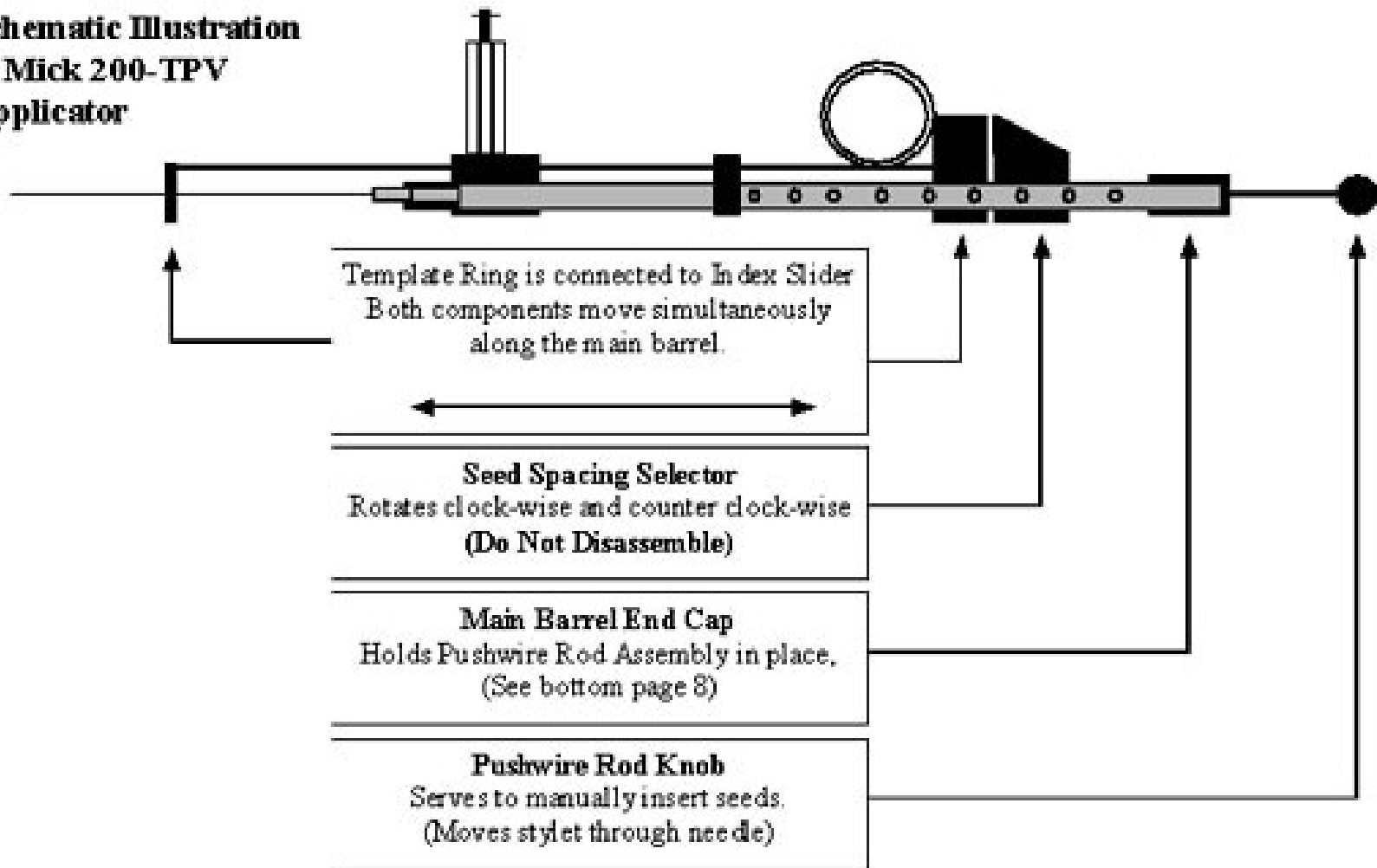
# MICK 200-TPV APPLICATOR

- Instantaneous Seed Spacing Variability
- Autoclaveable



# Mick Applicator Schematic

## Schematic Illustration of Mick 200-TPV Applicator



# Variable selector on neutral



# Pre-Load and Mick Needle Tips



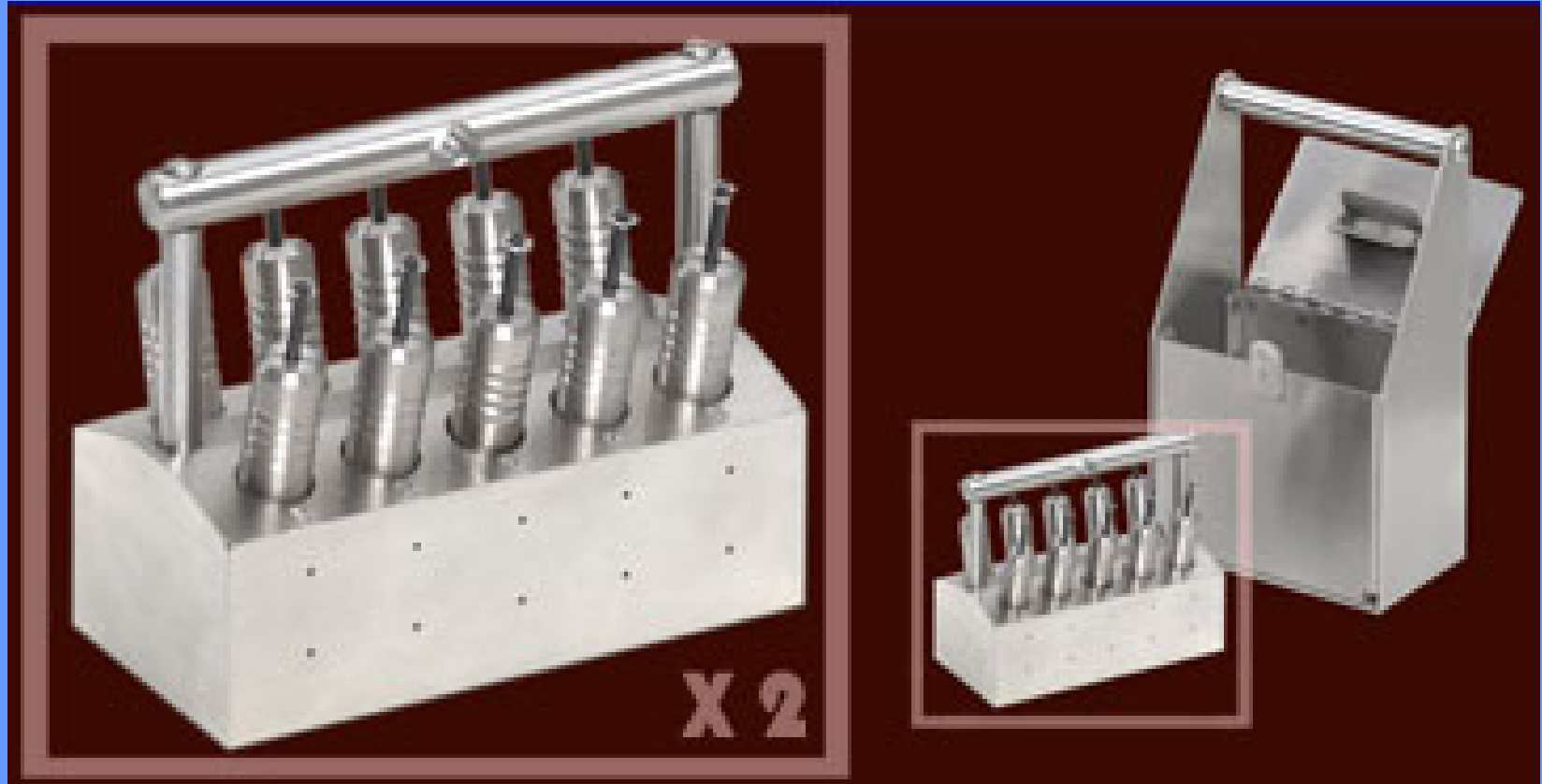
**Most implant needles are disposable and shipped sterile.  
Mick needles are available both 17 and 18 gauge.**

# SEED CARTRIDGES

- Come loaded from factory  
15 seeds/ cartridge  
Disposable  
Auto-clavable  
No staff preparation  
Can assay seeds in  
cartridge



# Seed CARRIER





# MICK APPLICATOR

## PRO'S

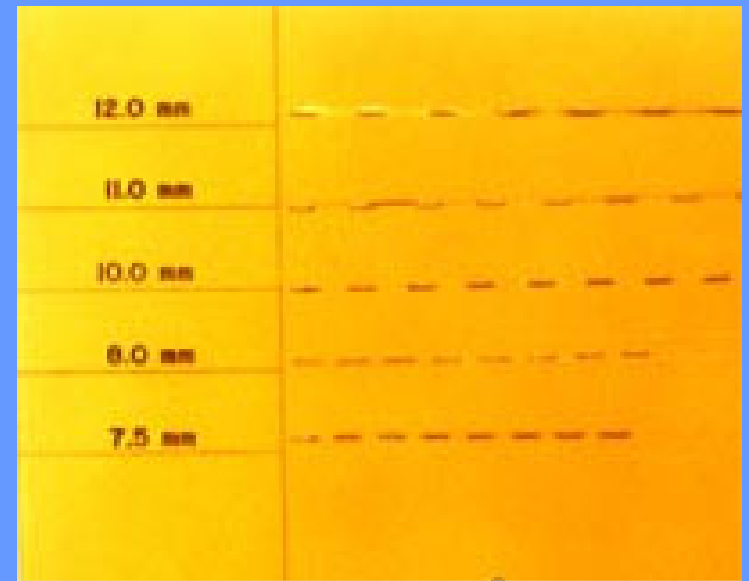
- Flexible & adaptable to prostate volume change.**
- May vary seed-to-seed distance within a needle.**
- Image guided optimization of each implant.**
- No spacers, bone wax, or rulers needed.**
- No added needle loading time or costs.**
- Monitor for and replacement of migrated seeds.**

## CON'S

- Surgical equipment learning curve.**
- Shifts seed placement responsibility to Oncologist.**
- Seeds can “slide or shift” along needle track.**

# MICK APPLICATOR

- **Variable intra-needle seed separation.**
- **Internal seeds.**
- **10-12mm apart.**
- **Peripheral seeds.**
- **5-7mm apart.**
- **“Peripheral loading with less needles”.**



# Image Guided Seed Placement

- **Real time feedback of prostate size**

- **Prostate is smaller:**

  - Hormone therapy**

  - Pelvic XRT**

  - Tension on urinary catheter bulb**

- **Real time feedback of prostate size**

- **Prostate is larger:**

  - Intraoperative swelling 30-50%**

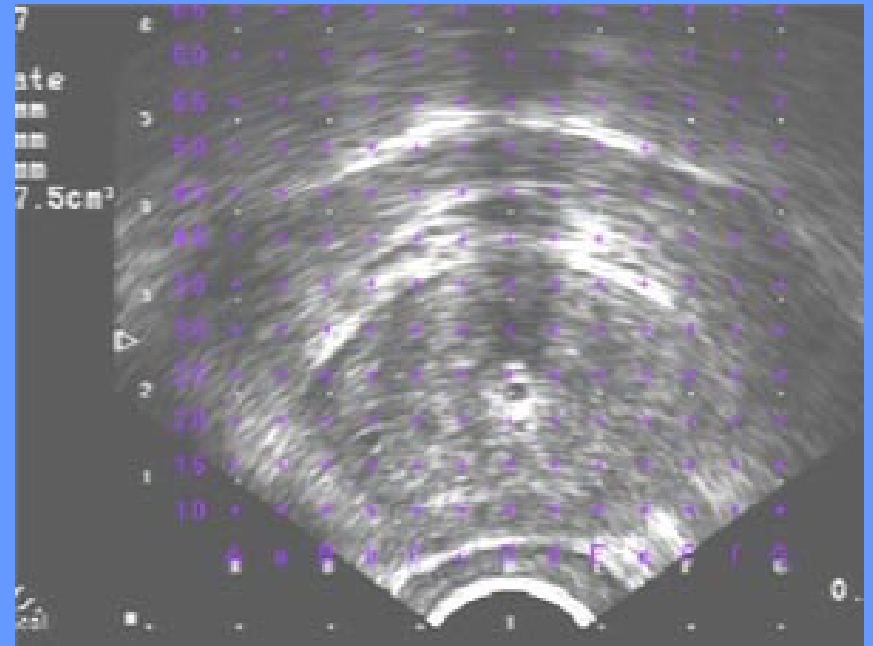
  - Edema**

# Variable Prostate Size/Shape

- Bladder distention over time.
- Pelvic floor relaxation from Anesthesia.
- Catheter placement.
- Suboptimal volume study.
- Placement of other needles.
- Different seed strength than planned.
- Pubic arch interference.

# ULTRASOUND PREPLAN

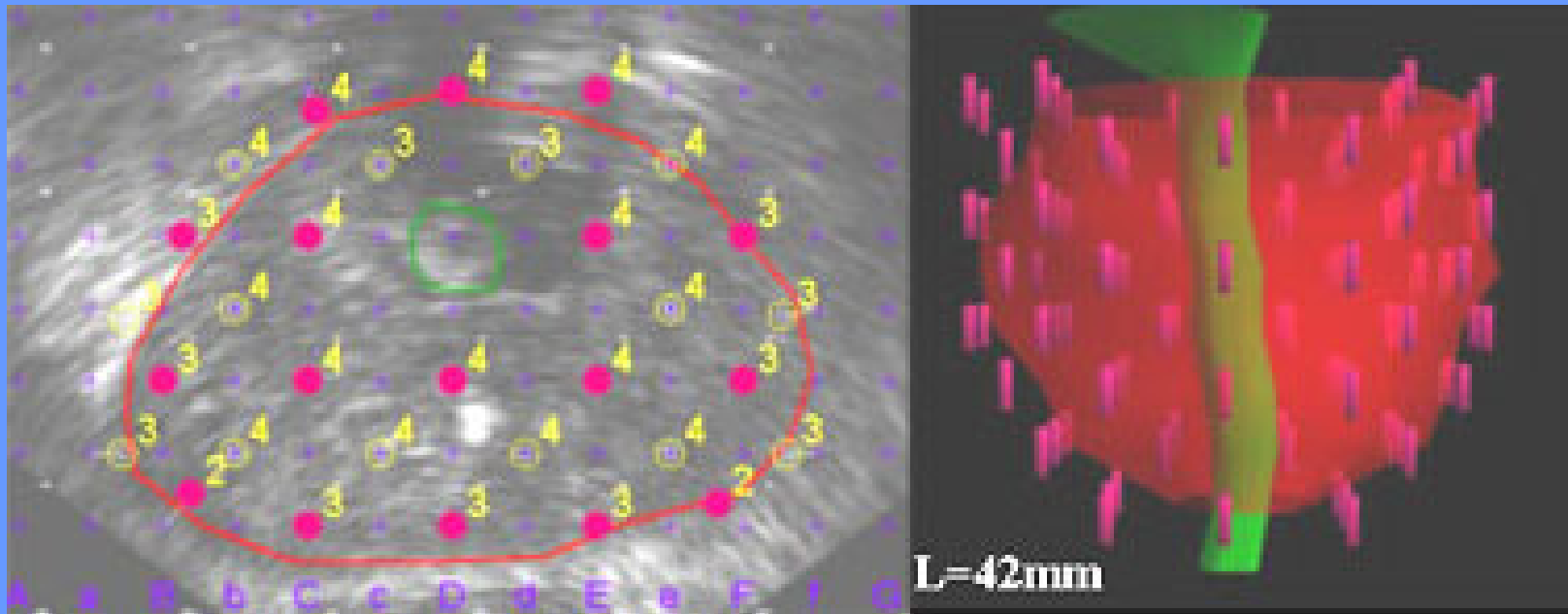
- **Size and shape.**
- **Urethra location.**
- **Number and activity of seeds.**
- **Size and shape of TURP defect.**
- **Median lobe.**



# Traditional Preplan

**Assumes either:**

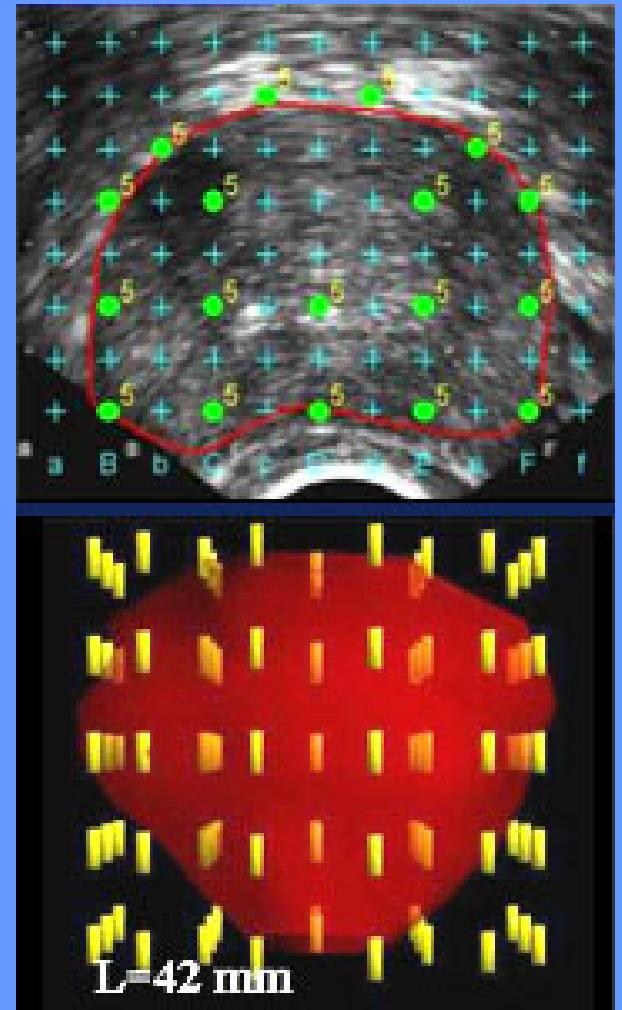
- 1) prostate doesn't move, change shape, or swell during implant; or**
- 2) planners can accurately predict amount of edema.**



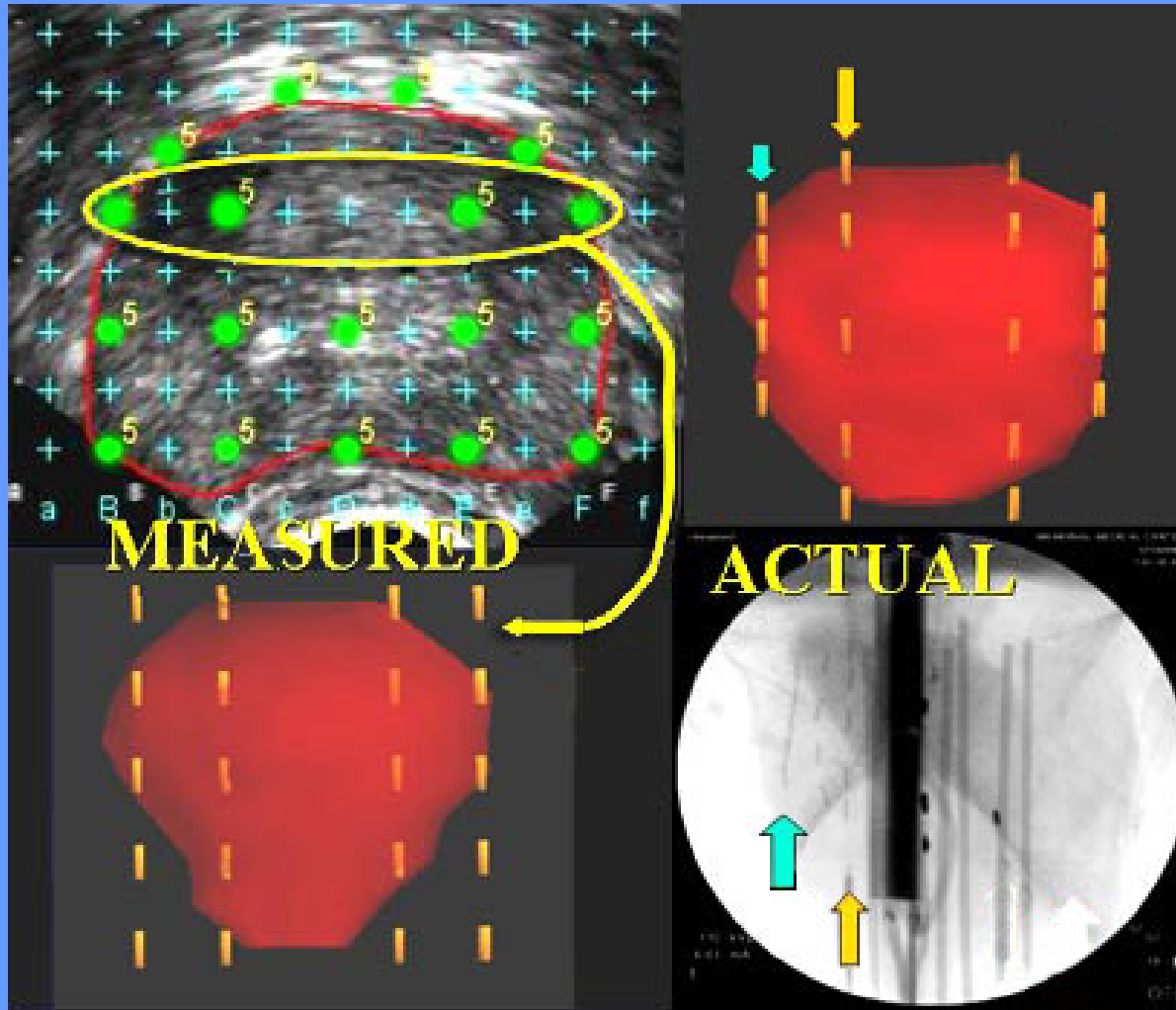
# HYBRID INTERACTIVE PRE-PLANNING

## Advantages:

- Simple Quimby cylinder load.
- Acts as guide only
- Allows for accurate ordering of seeds.
- Needles at least 1cm apart and 5mm from urethra.
- All needles within the prostate at widest cut.
- Number of seeds per needle=prostate length+1



# SEED PLACEMENT





# SETUP

- Mick Needles
- Mick Cartridges w/ seeds
- Mick Applicator
- Seed passer
- Rectal suction tip
- Foley Catheter w/ contrast
- Sharpened needle for gold fiducial marker.
- Basin for sharps
- Bowl for perineal pressure



# OR: PREPARING THE PATIENT

- **Suctioning the rectum.**
- **Removes feces, mucus, and gas.**
- **Ensures clear sagittal ultrasound view**
- **Done prior to perineal prep.**
- **Fenestrated suction tip with wall suction**

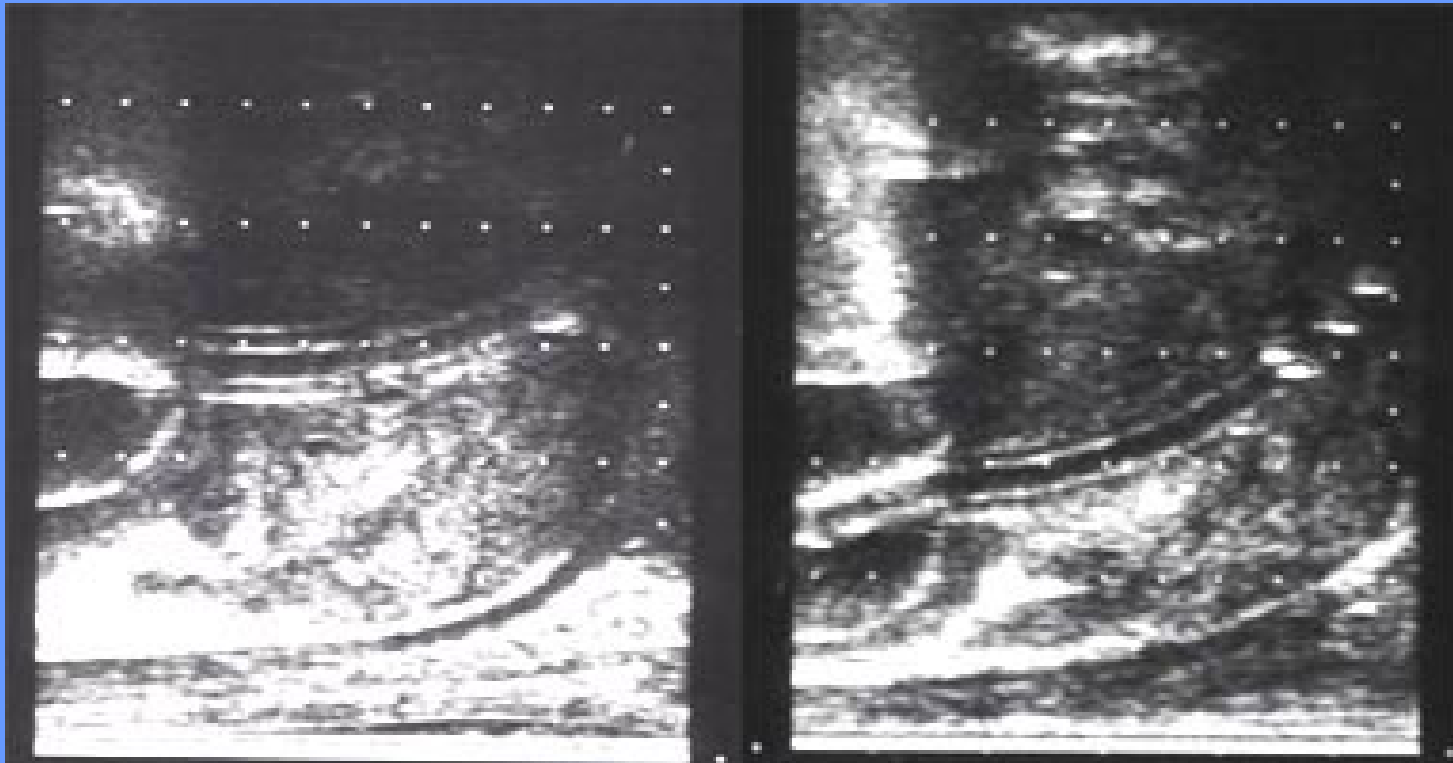


# PREPARING THE PATIENT

- **Scrotal retraction.**
- **14-16 F Foley, 10cc balloon (retracted to bladder base)**
- **Drain bladder.**
- **Add 60cc diluted contrast in bladder, then clamp Foley**



# WHY A CATHETER?



# INTRA-OP GUIDE

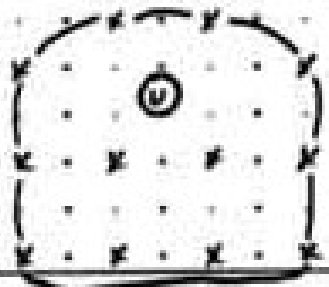
Radiation Oncologist:		Urologist:	
CS:	PSA:	Radiation Oncologist:	Urologist:
GS:	Tumor Loc:	CS:	PSA:
Template Coordinates used for preplanning		Template Coordinates used for preplanning	
6	.....	6	.....
5.5	.....	5.5	.....
5	.....	5	.....
4.5	.....	4.5	.....
4	.....	4	.....
3.5	.....	3.5	.....
3	.....	3	.....
2.5	.....	2.5	.....
2	.....	2	.....
1.5	.....	1.5	.....
1	.....	1	.....
	A a B b C c D d E e F f G		A a B b C c D d E e F f G

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	A a B b C c D d E e F f G		A a B b C c D d E e F f G

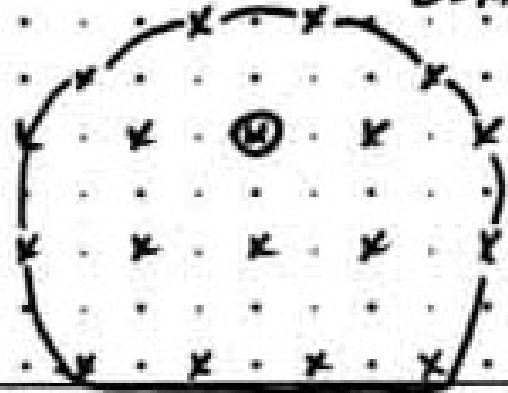
EX. #2 WIDEST CUT OF GLAND

LENGTH = 4 SEEDS PER NEEDLE



LENGTH = 4.5 SEEDS/NEEDLE @ 6

EX. #1 WIDEST PART OF GLAND



# OR SETUP

Room lights off/down low.

Fluoro and ultrasound monitors lined up.

Steri-drape covering ultrasound console and fluoro handle for rotation.

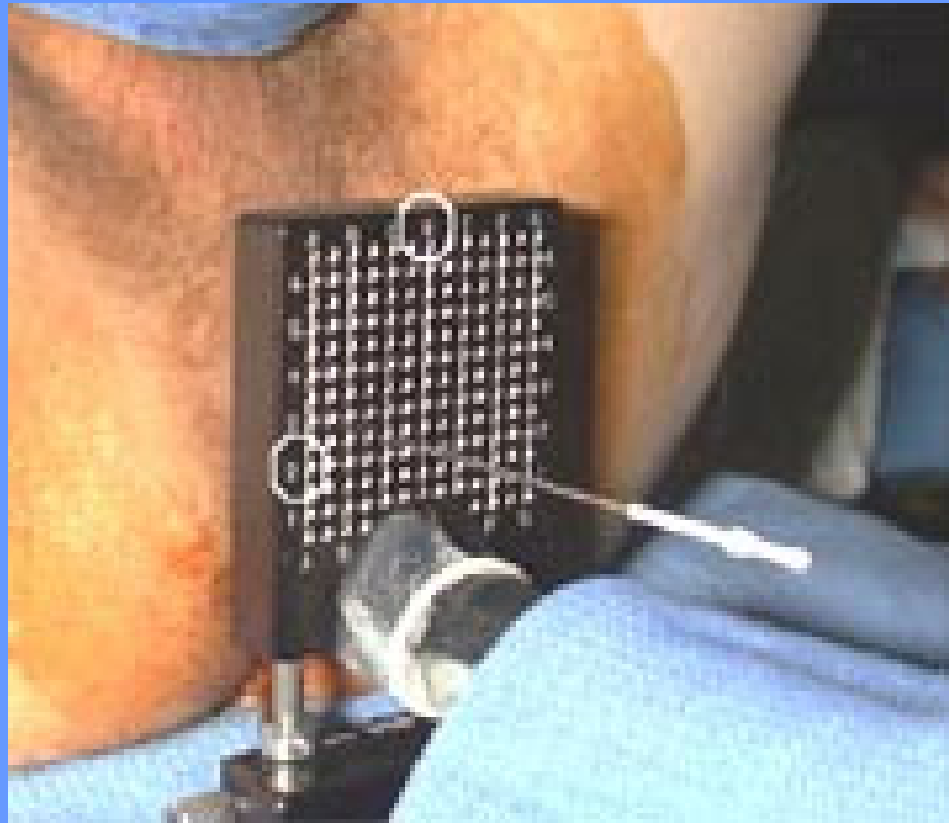


# FIDUCIAL GOLD APEX MARKER

- Placed at beginning of procedure using ultrasound guidance
- Allows verification of apex coverage and assurance that penile bulb or membranous urethra does not get implanted.
- Excellent visual correlation between ultrasound, fluoroscopy, and CT.

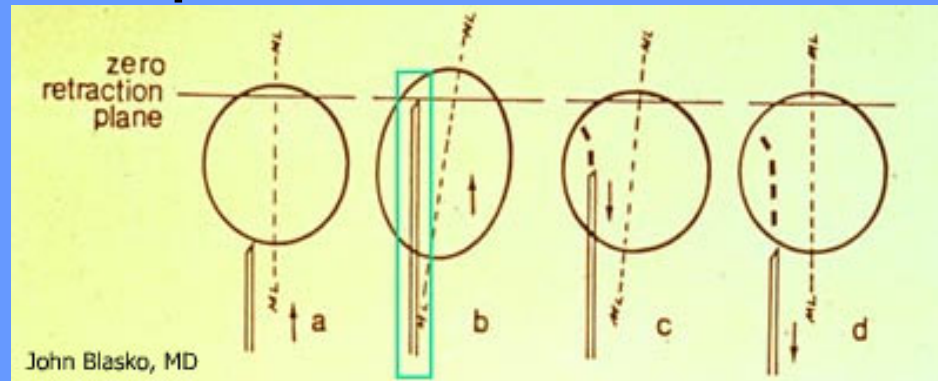


# GLAND IMMOBILIZATION





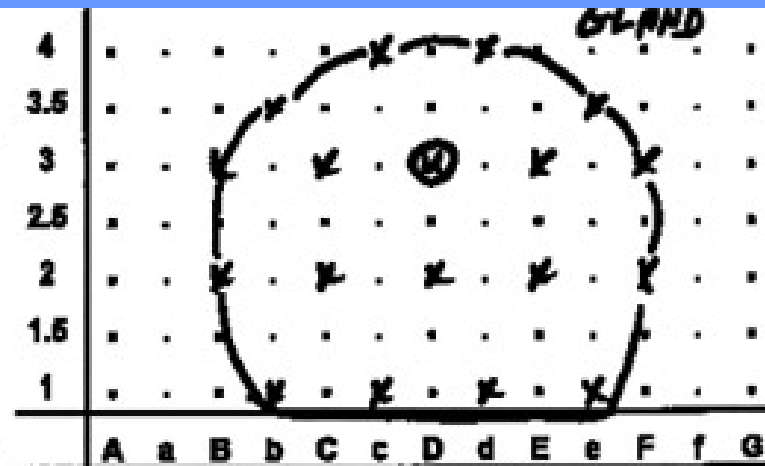
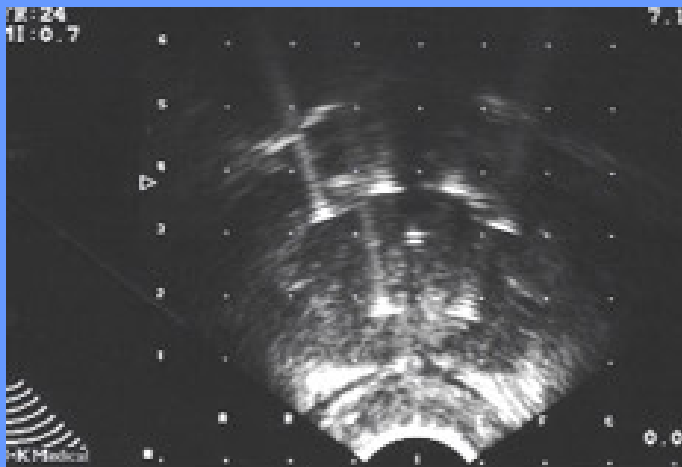
# Rotational effect from Insertion of Lateral Needles and Resulting Coverage Gaps at Prostate Base



- a) Prostate before insertion of lateral needles
- b) Rotation of Gland off axis as needle is inserted
- c) As needle is withdrawn, gland begins returning to normal shape with tissue moving inferiorly and laterally
- d) Irregular distribution of seeds resulting from inferior, lateral movement with potential coverage gap at base

# NEEDLE PLACEMENT

- Needles placed in most anterior row first.
- Needles placed medially to laterally within each row.
- Needle depth to mid- gland.



# AXIAL ULTRASOUND

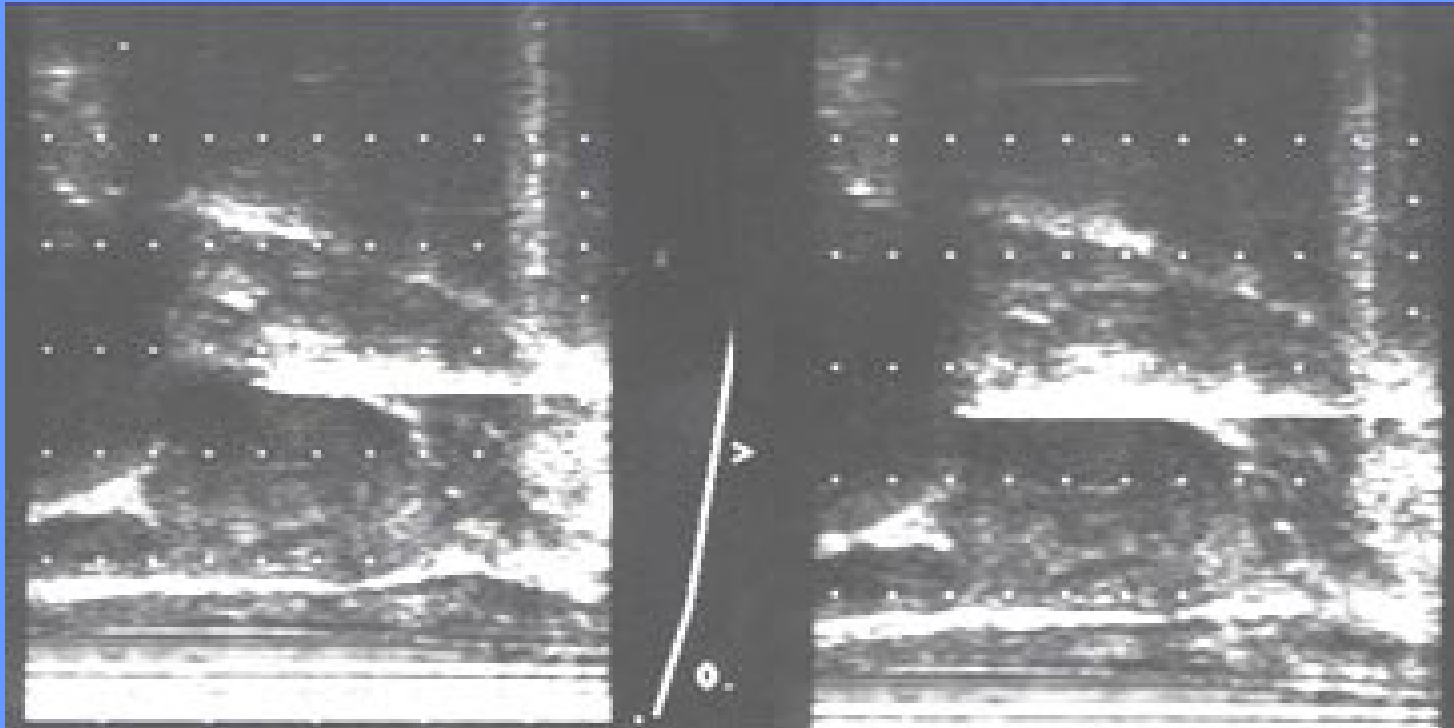


# NEEDLE PLACEMENT

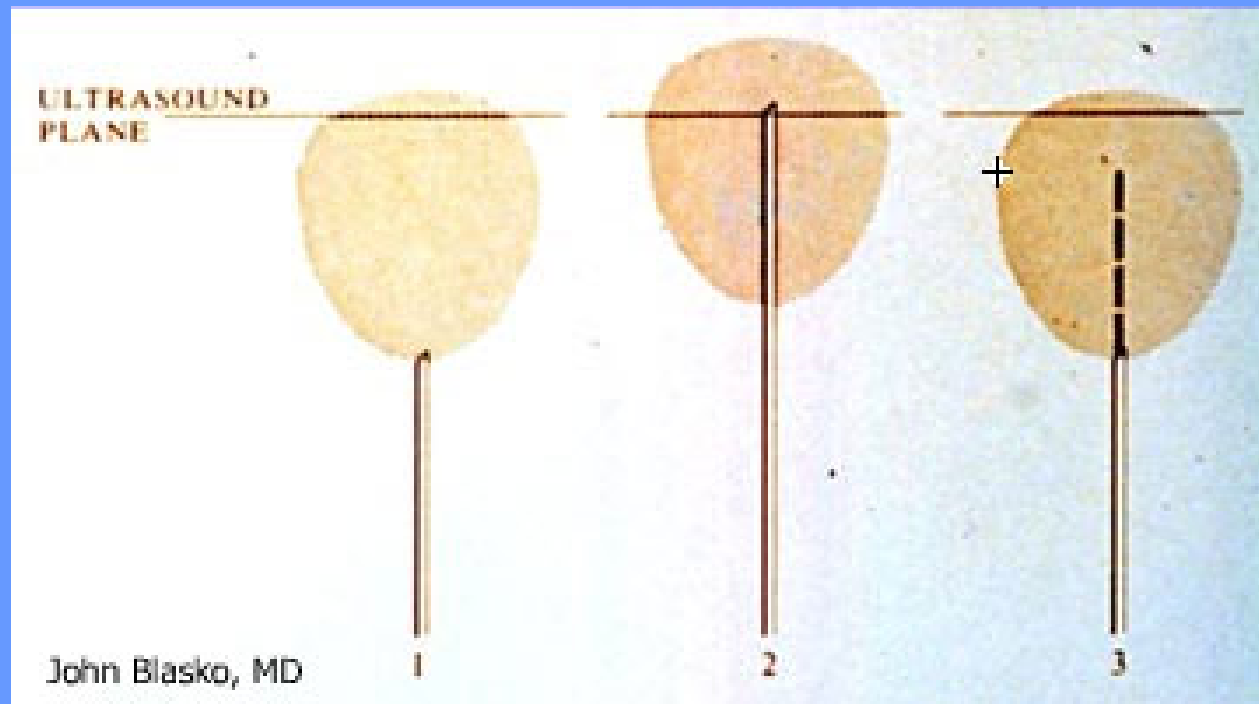
- **Depth of each needle determined and confirmed by sag. ultrasound.**
- **Accurate needle placement improves seed implantation.**



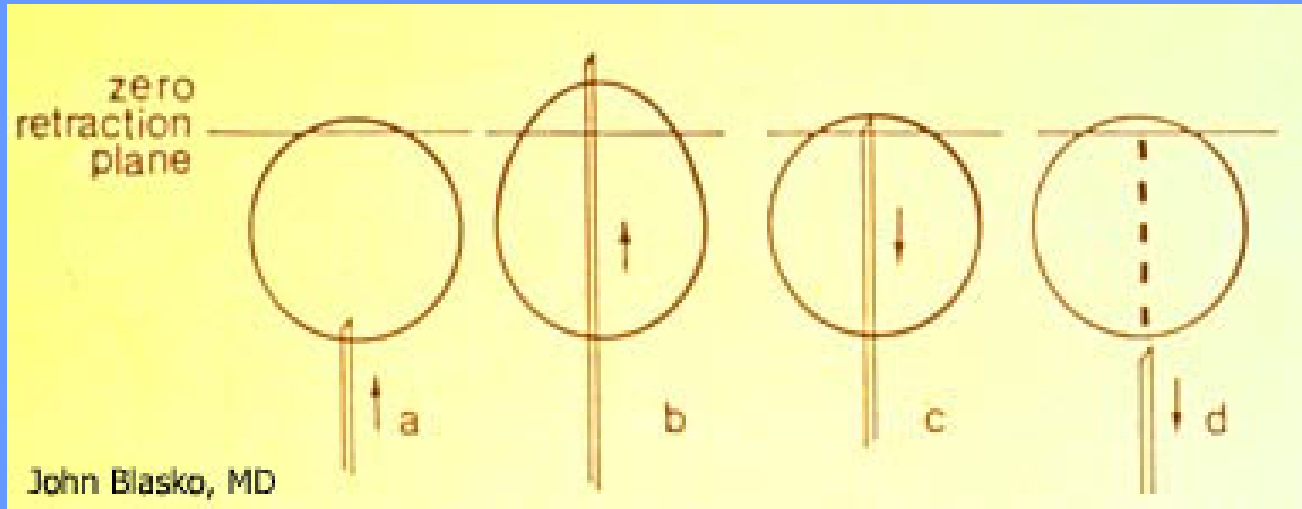
# Sag. Ultrasound



# Prostate Superior Displacement "Needle Tenting Effect"



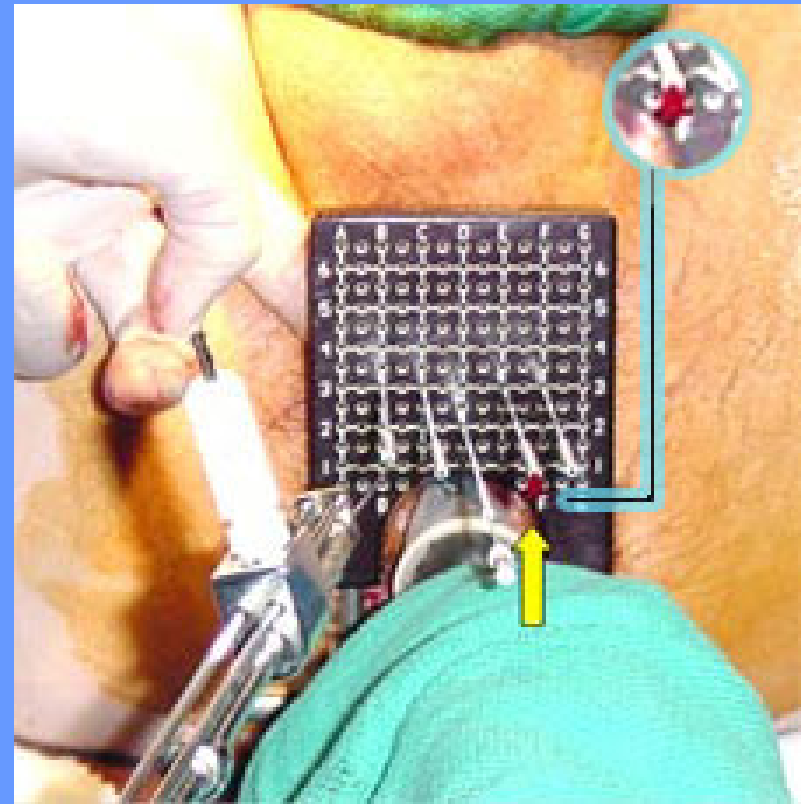
# Technique to Correct for "Tenting Effect"



- a) Normal prostate shape before needle insertion
- b) Insertion of needle thru the prostate (Use sagittal Trus approximately 2mm beyond zero retraction plane)
- c) Withdrawal of needle back to zero retraction plane allowing prostate tissue to resume normal shape
- d) Insertion of seeds with satisfactory alignment

# FINGER “DOOR STOP”

- Trocars removed
- \*Bleeding or urine quickly identified
- Needles can be slightly repositioned at this time if needed





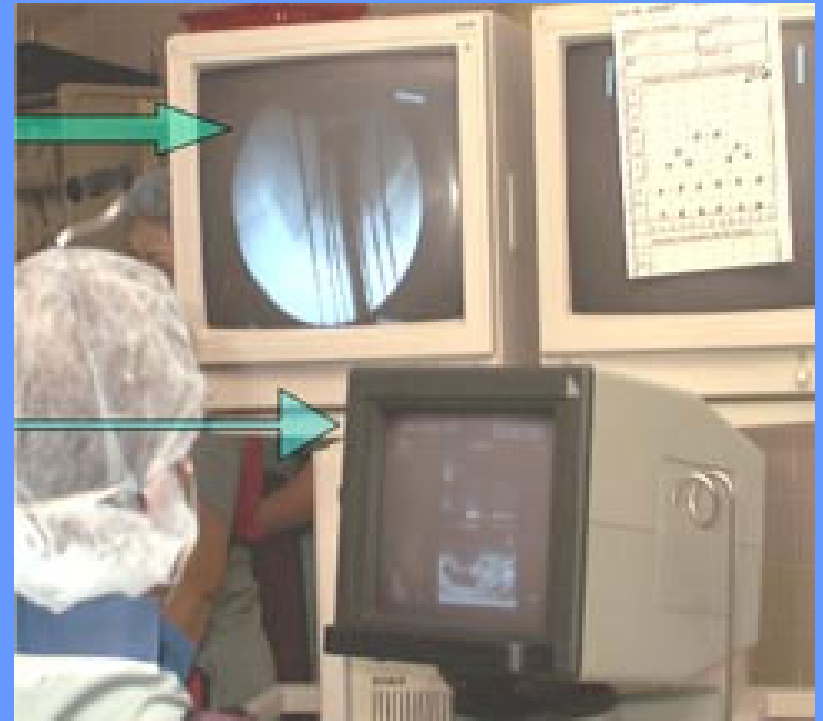
# TEAM APPROACH

- **Oncologist and Urologist work closely together.**
- **60-150 seeds placed.**
- **Monitoring of fluoroscopy and ultrasound throughout.**

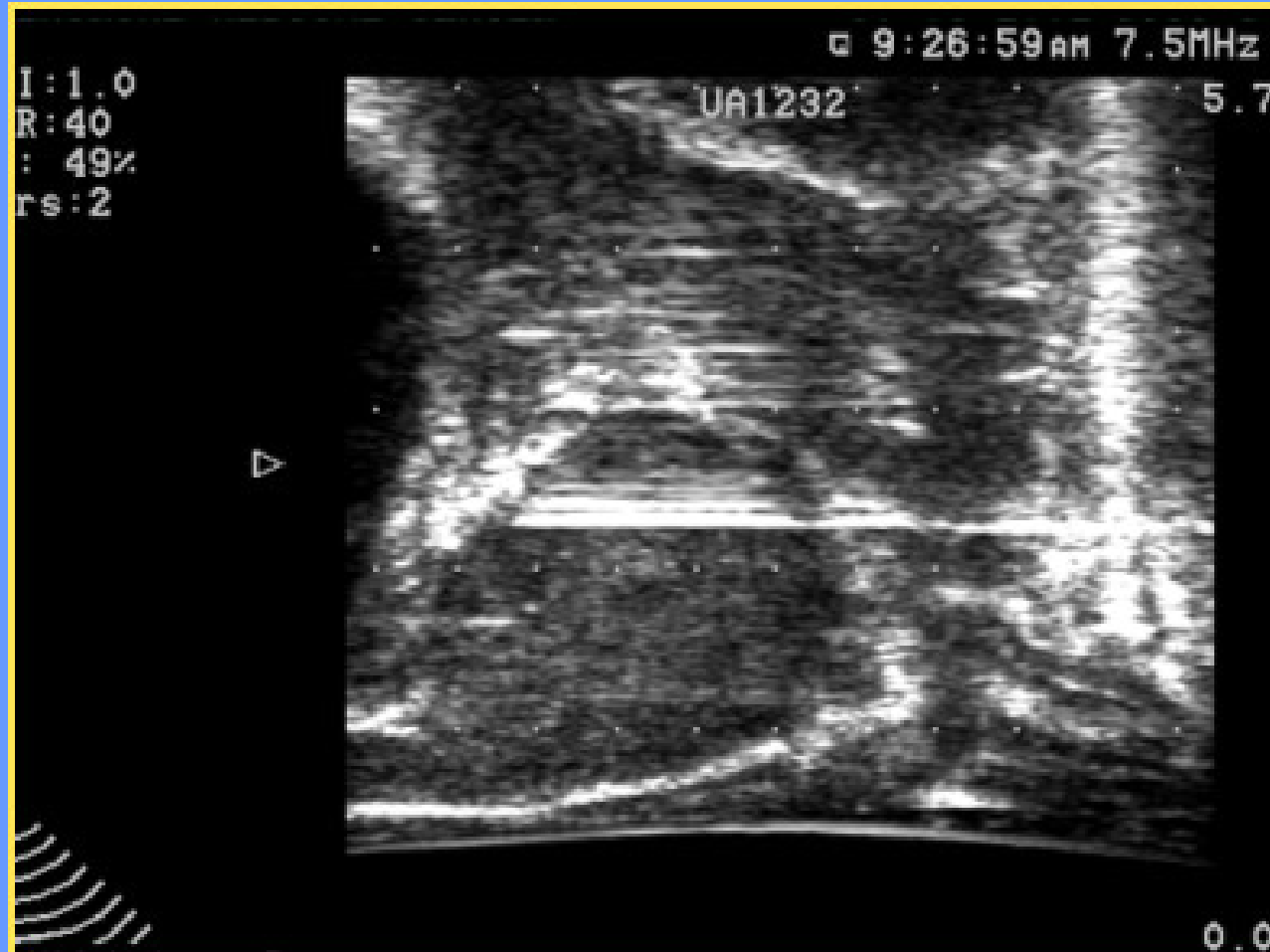


# IMAGE GUIDED SEED PLACEMENT

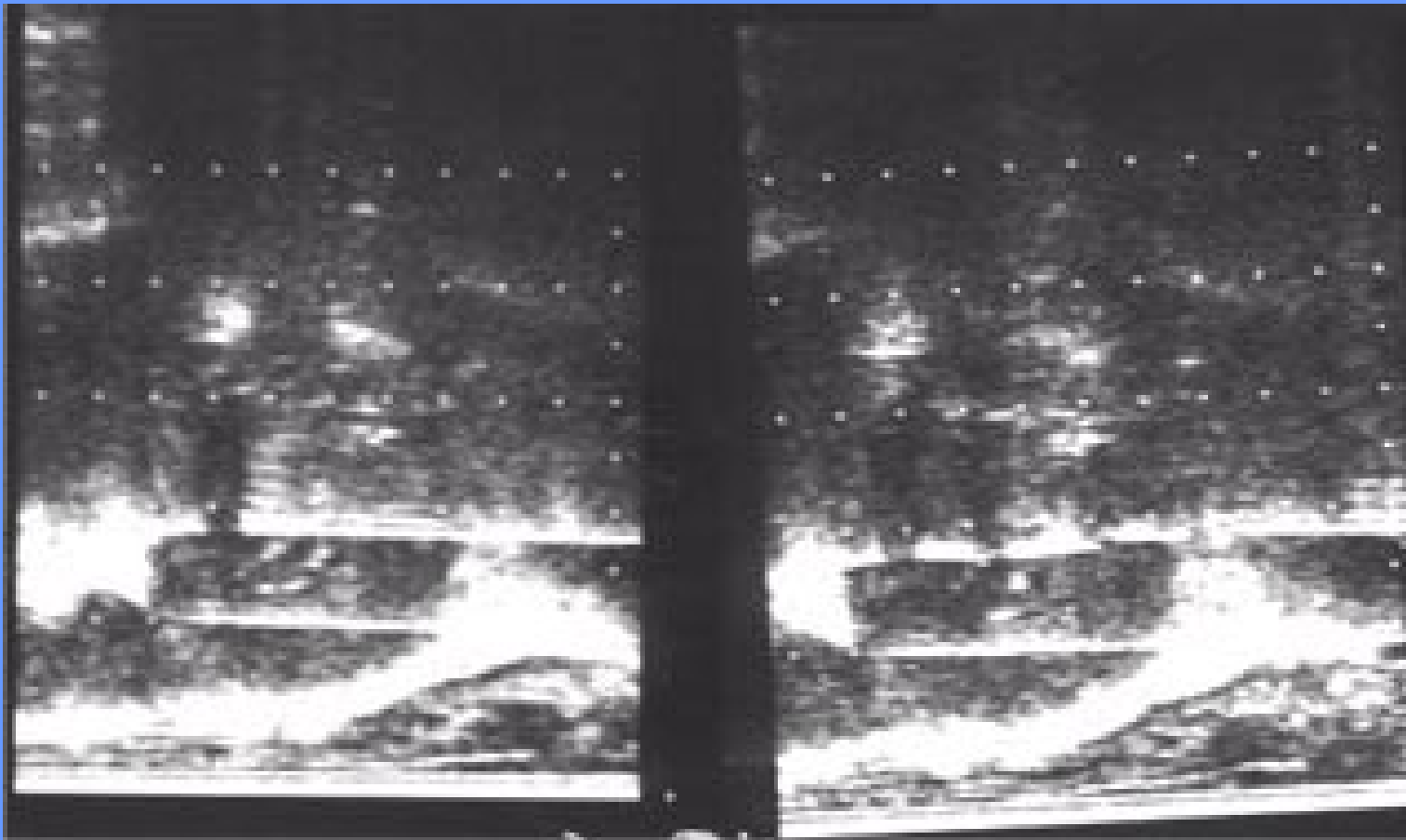
- Direct visualization of needles, seeds, and gold apex marker with fluoroscopy.
- Direct visualization of prostate, needles, and seeds with ultrasound.
- Real time visualized placement ensures coverage of entire prostate



# Create Pocket for 1st Seed

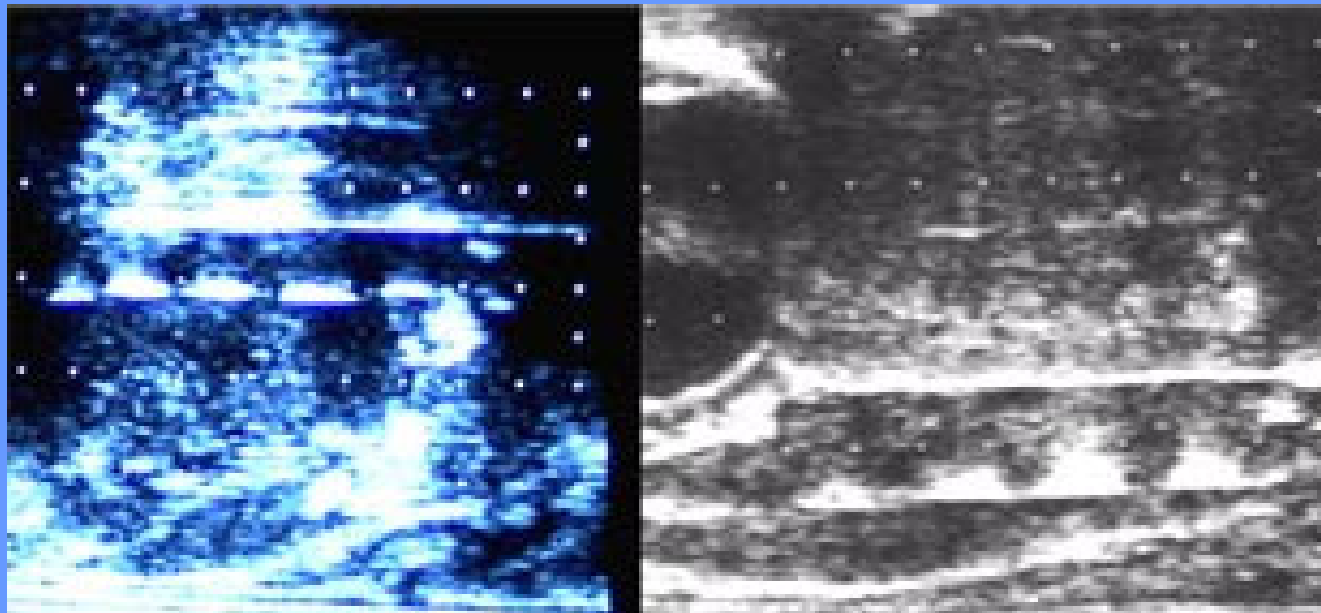


# SEEDS DROPPING



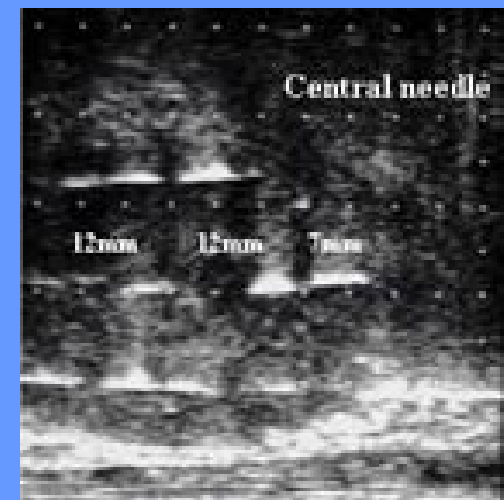
# SEED PLACEMENT

## Rotating the Sled

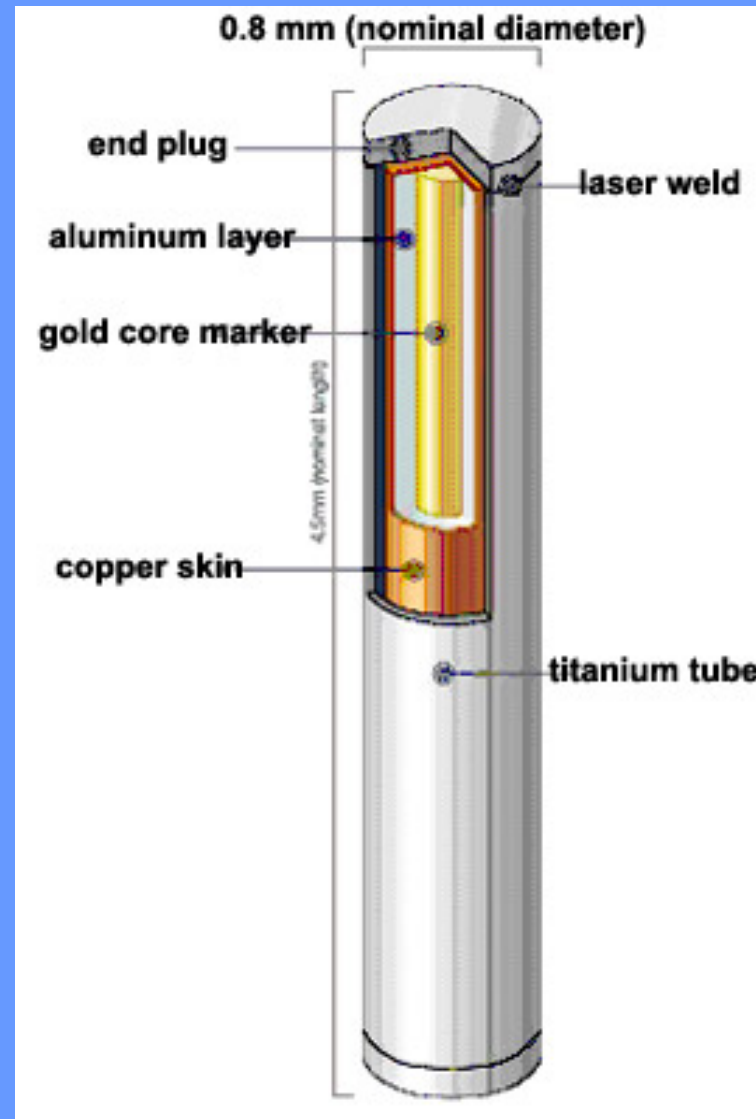


# SAGITTAL ULTRASOUND

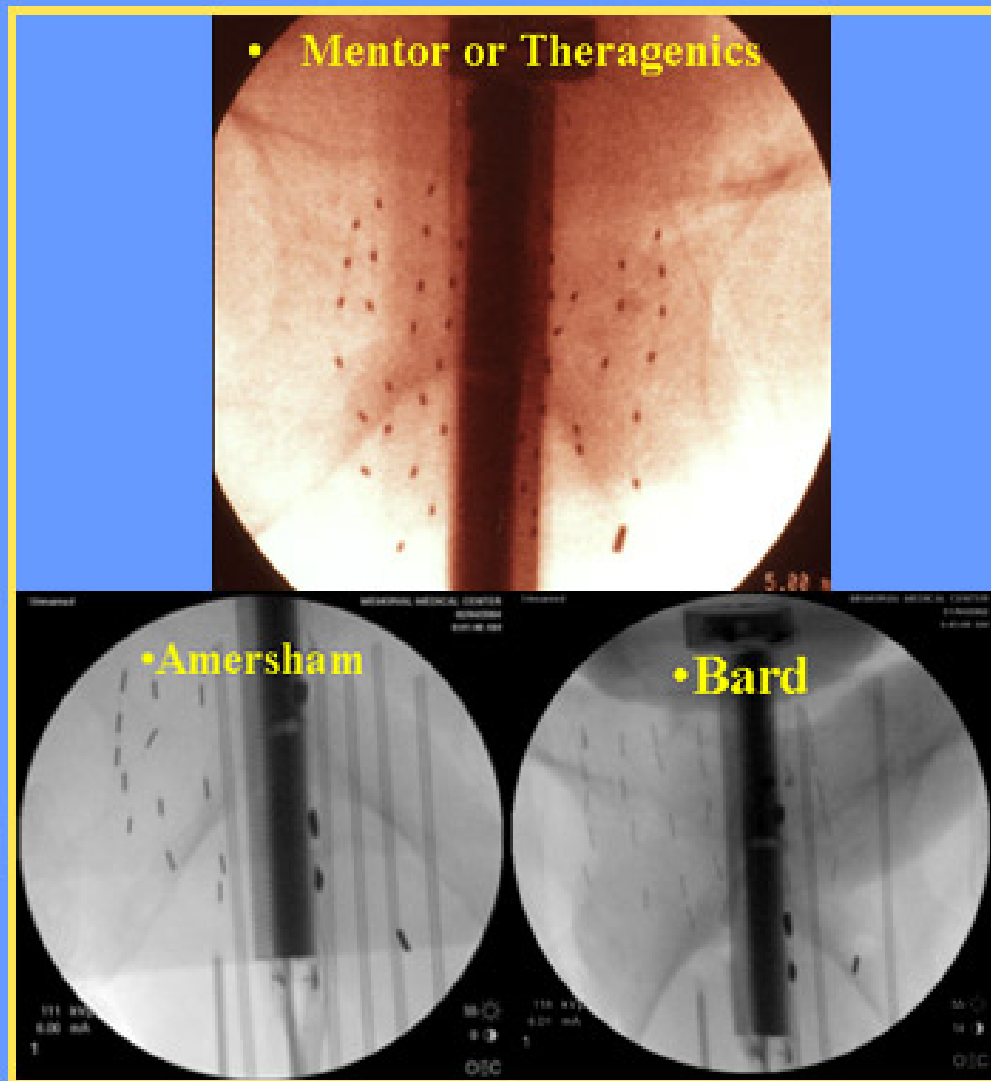
- The key to successful interactive placement of seeds.
- First and last seeds placed through capsule.
- Seed to seed separation clearly measurable and visible.



# MARKER IN SEEDS



# FLUOROSCOPY

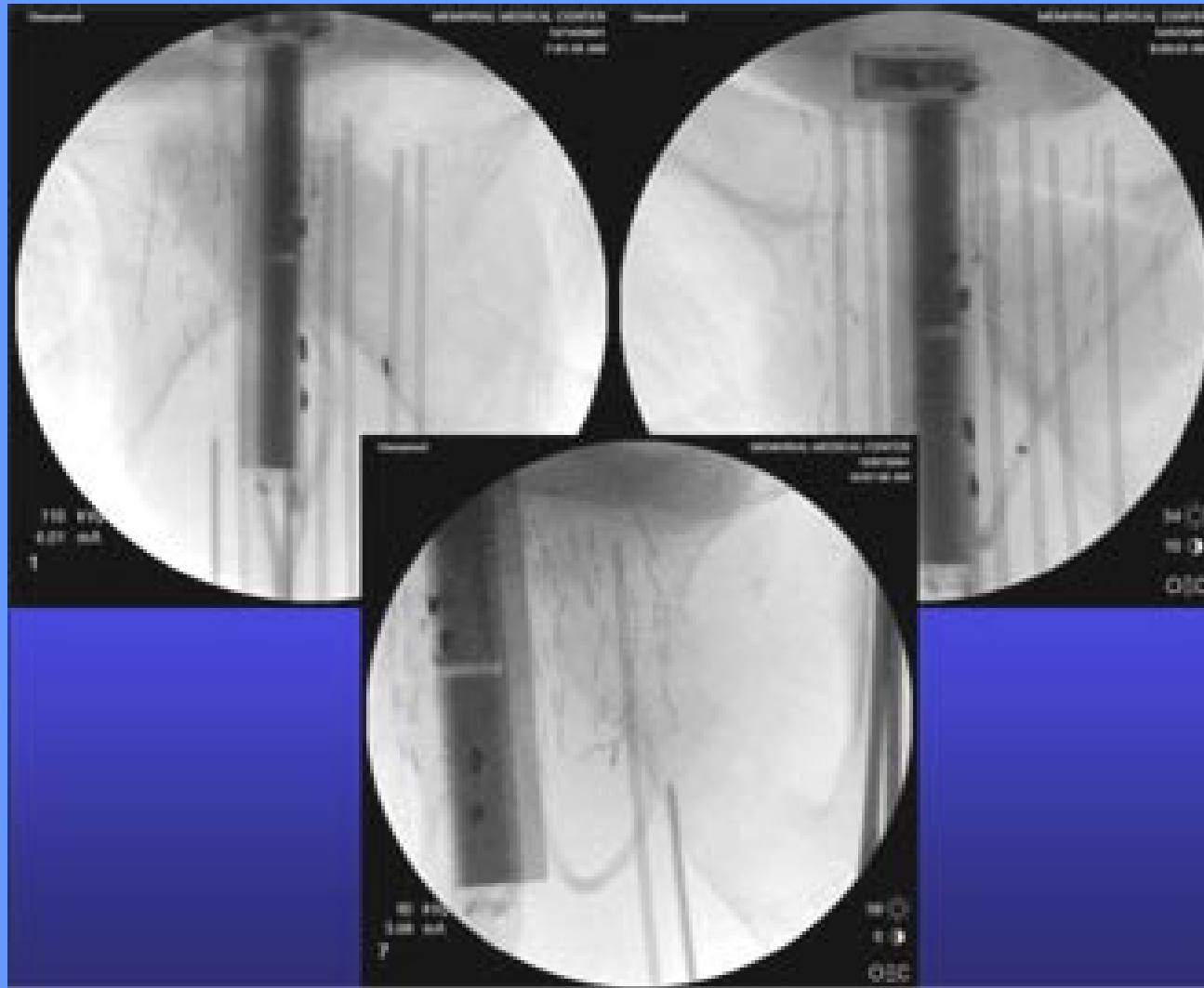




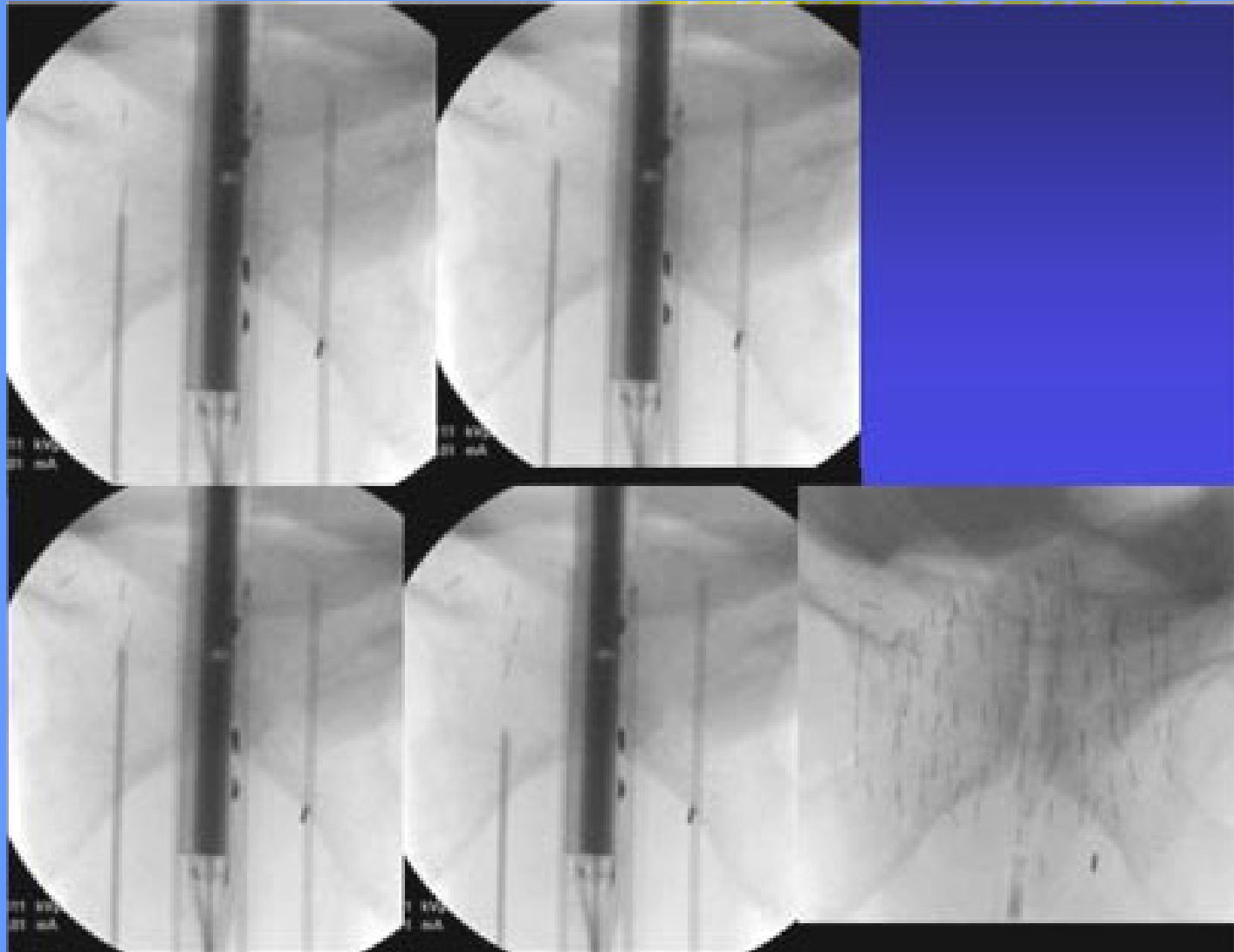
# Variable spacing on fluoroscopy



# Fluoroscopic assist



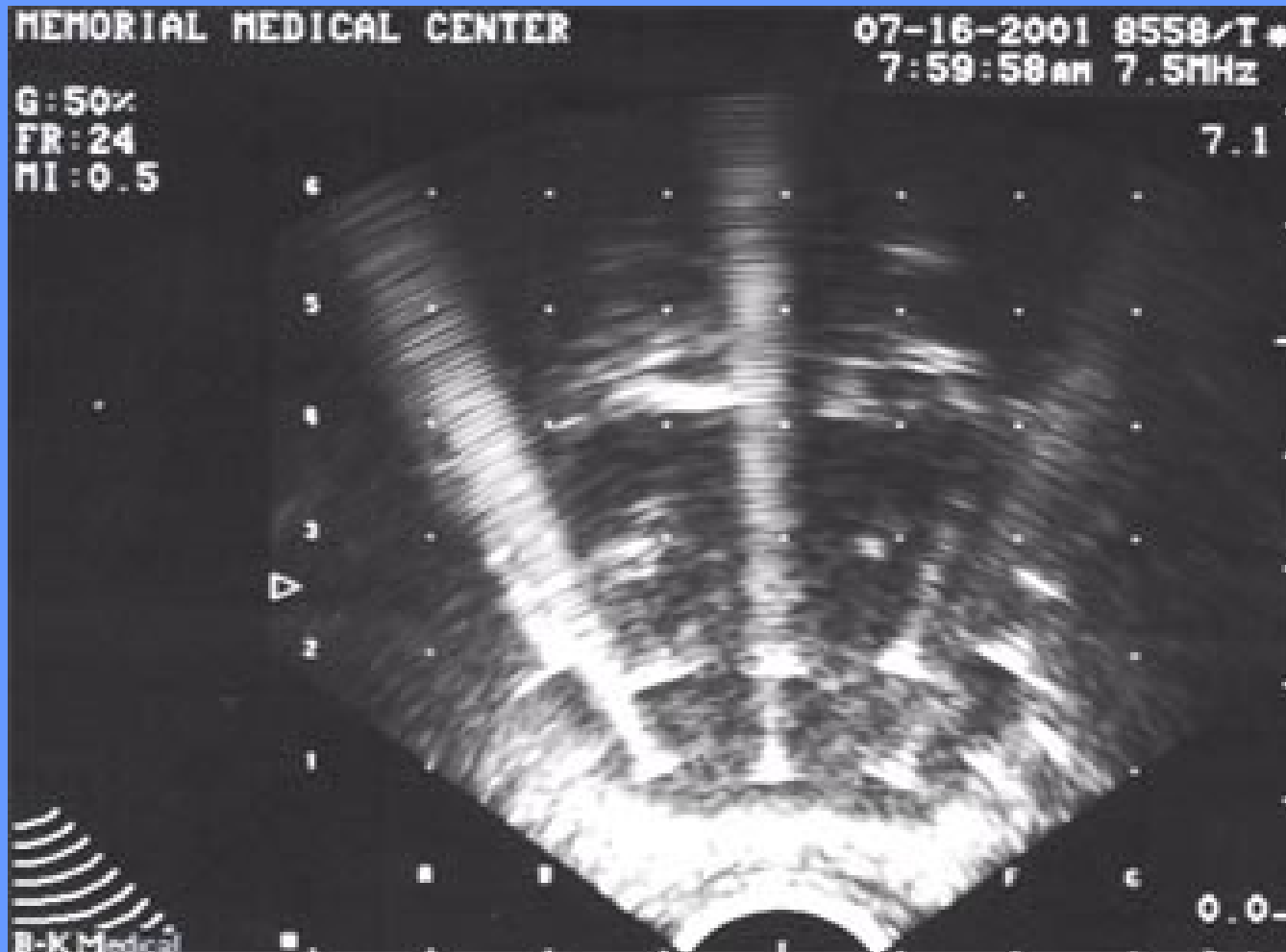
# CORRECTION OF SEED MIGRATION



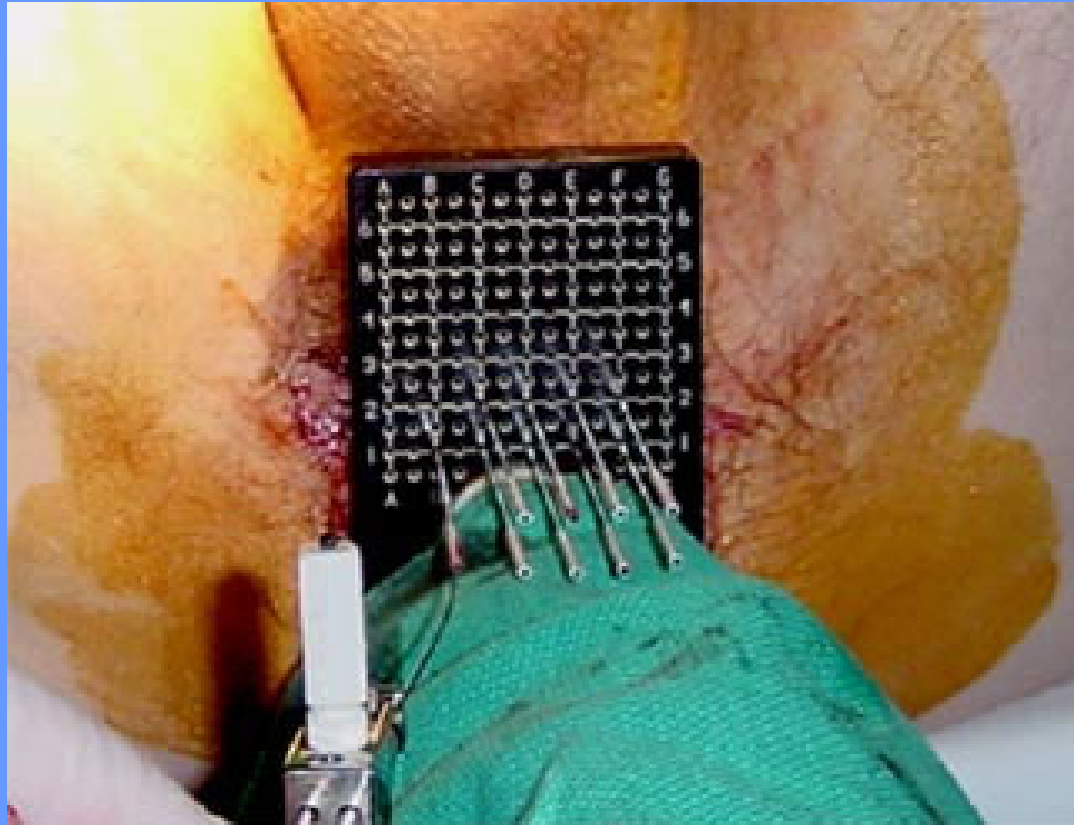
# NEEDLE PLACEMENT



# LAST TWO ROWS



# LAST TWO ROWS



# “POOR MAN’S CYSTO”

- 1) Advance Foley catheter to hilt and retract 2 times
- 2) Check fluoro of bladder for seeds
- 3) Open Foley clamp to drain urine.
- 4) If clear urine and no seeds in bladder, no cysto needed.

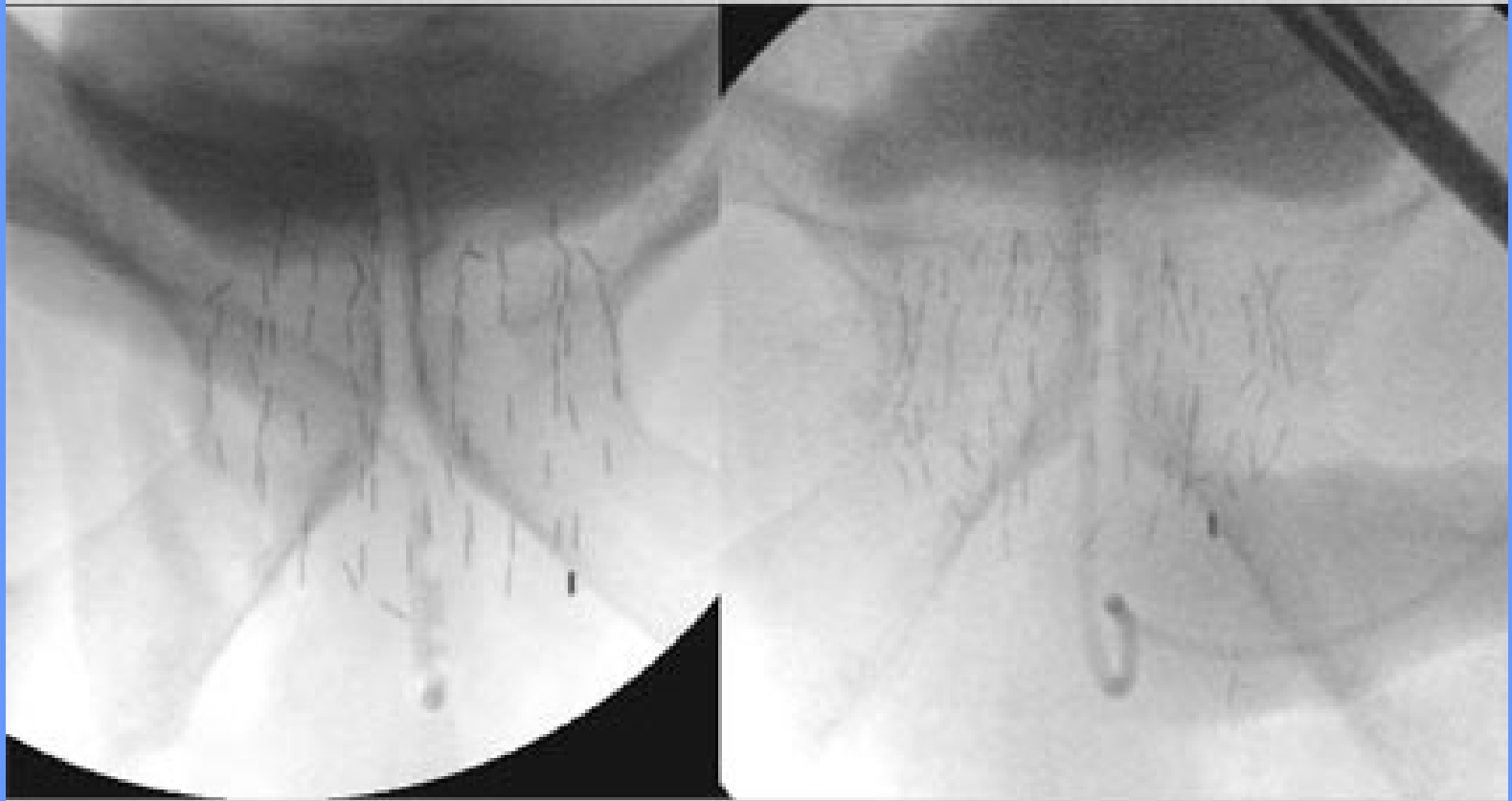


# Seed Migration in Bladder

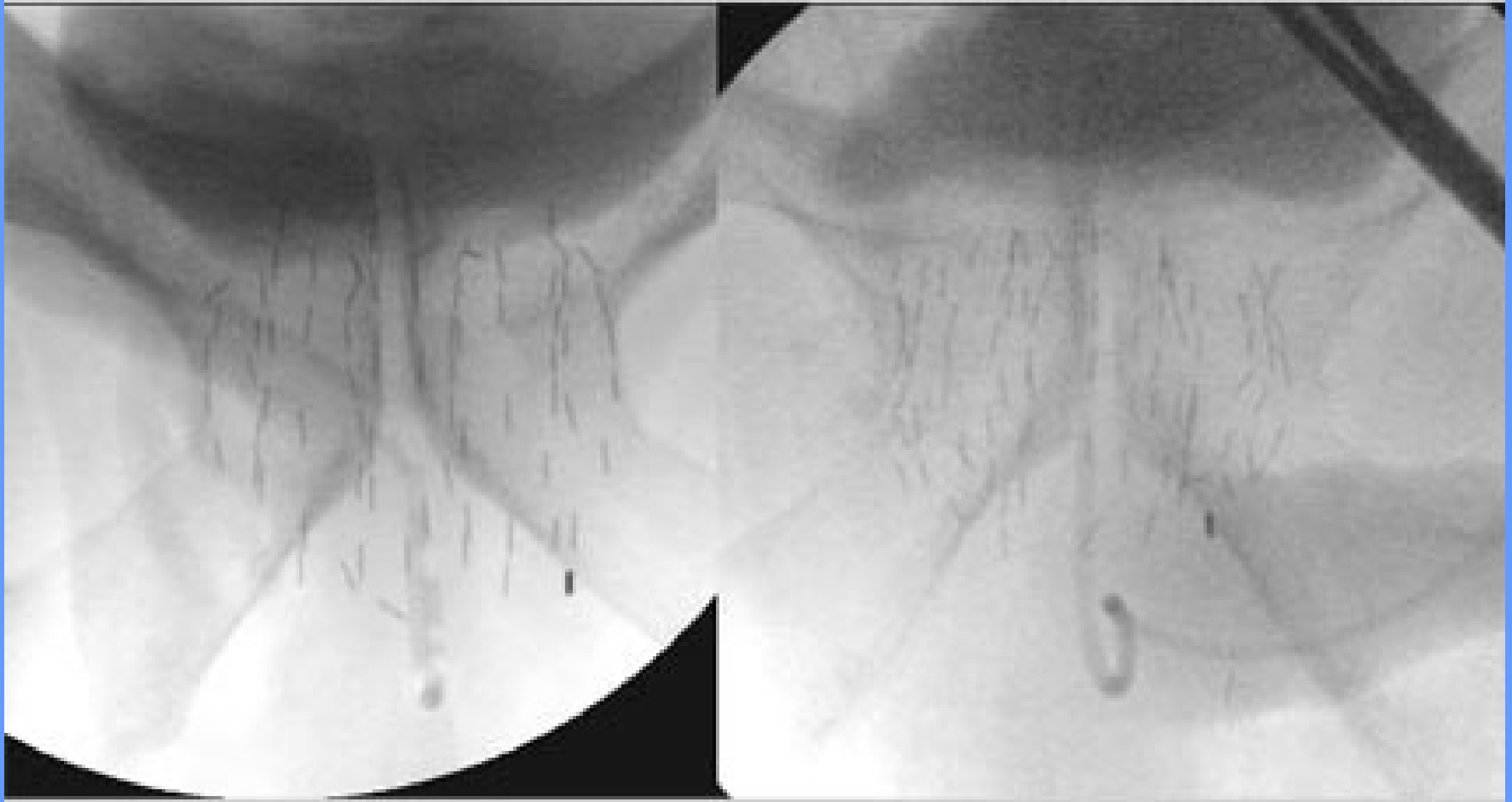




# “Seed waking” migration below prostate



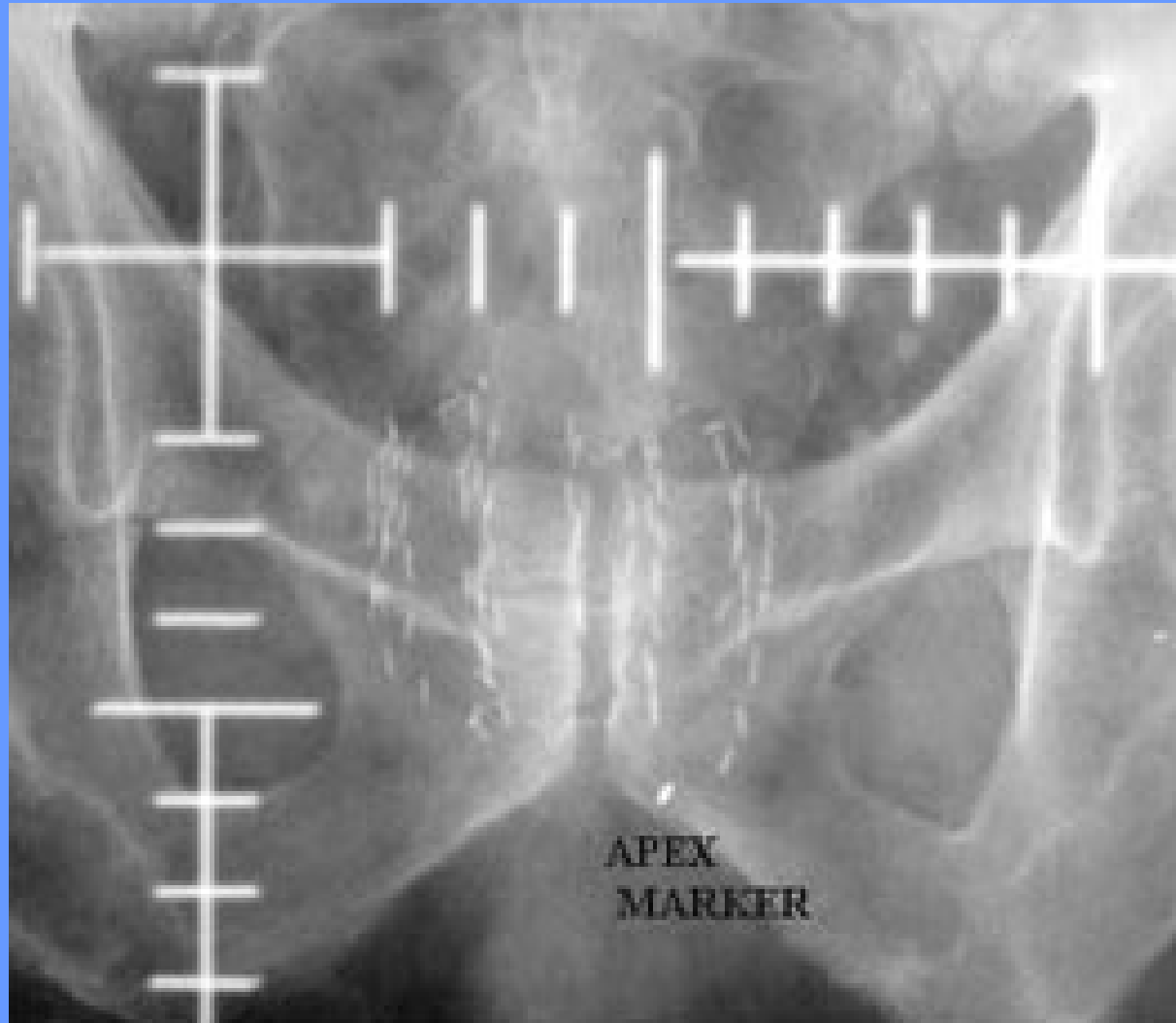
# “Seed waking” migration below prostate



# PERINEAL PRESSURE



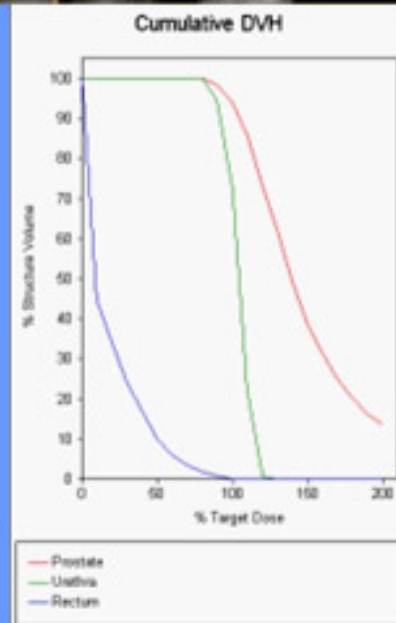
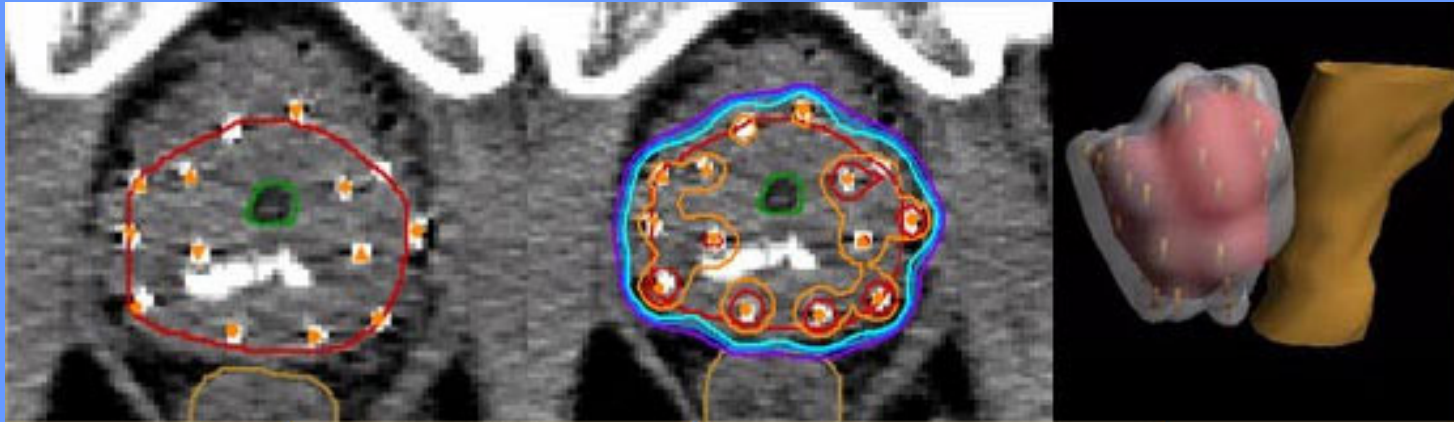
# SIMULATION







# DAY 0 POST IMPLANT CT VARISEED 7.1

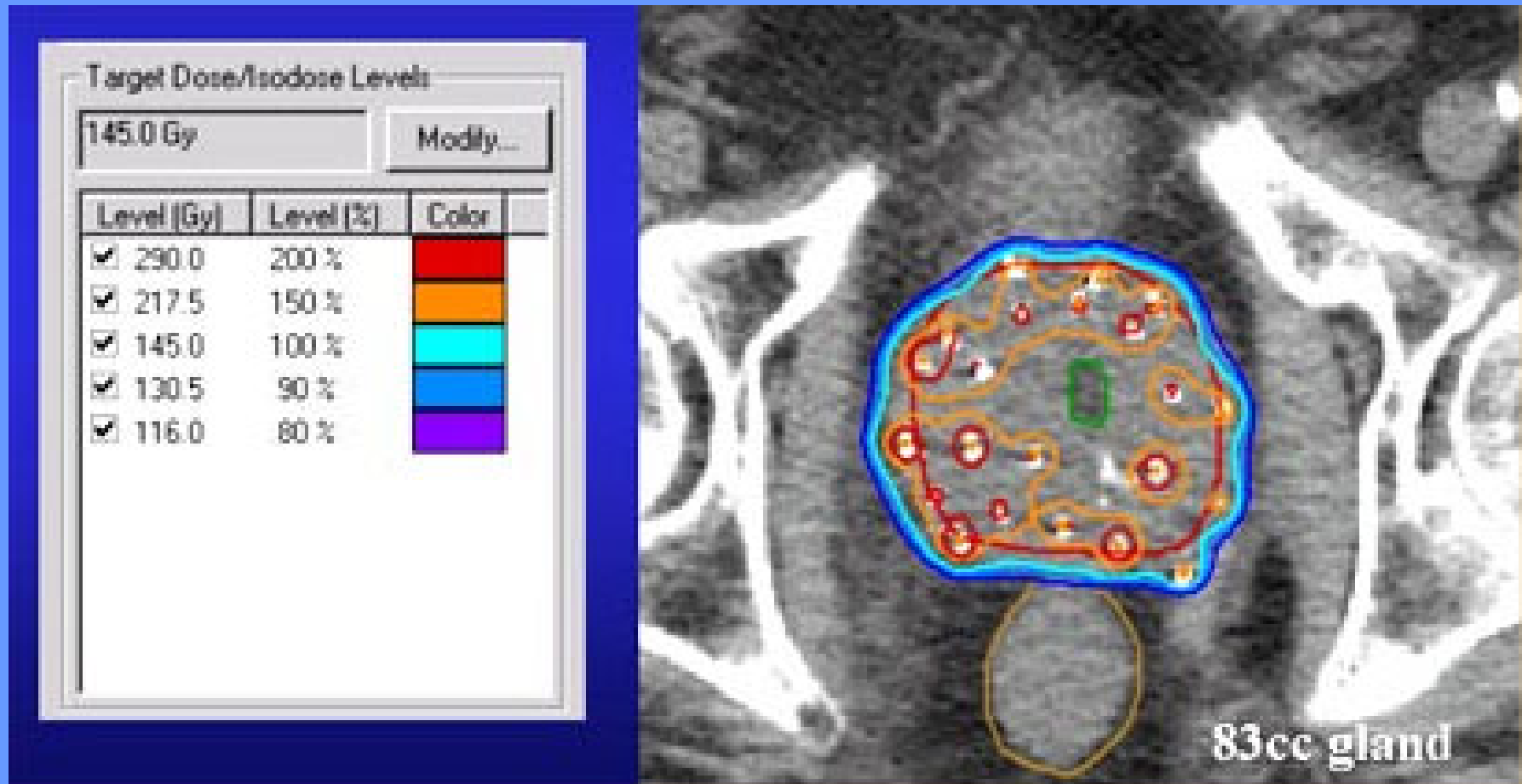


Target Dose/Isodose Levels

145.0 Gy

Level [Gy]	Level (%)	Color
<input checked="" type="checkbox"/> 290.0	200 %	Red
<input checked="" type="checkbox"/> 217.5	150 %	Orange
<input checked="" type="checkbox"/> 145.0	100 %	Cyan
<input checked="" type="checkbox"/> 130.5	90 %	Blue
<input checked="" type="checkbox"/> 116.0	80 %	Purple

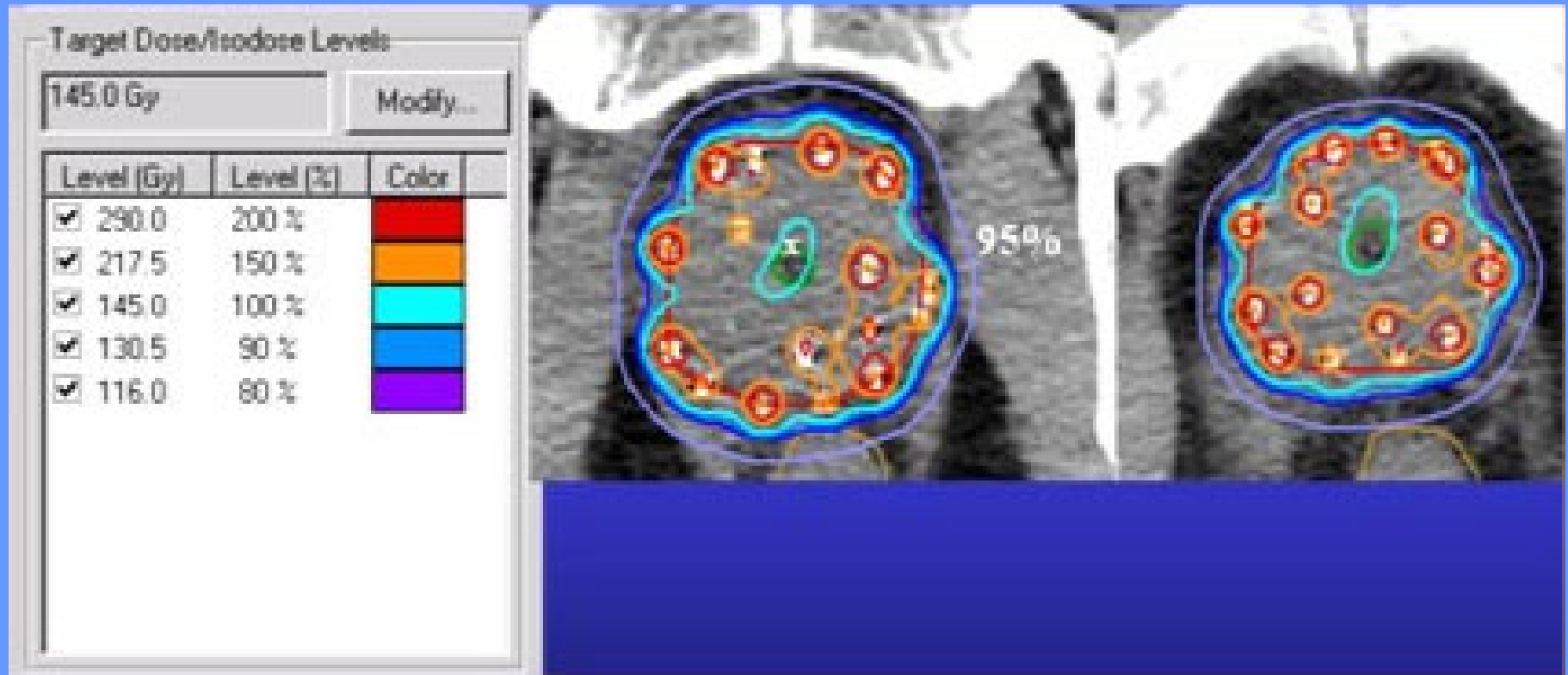
# DAY 0 POST IMPLANT CT



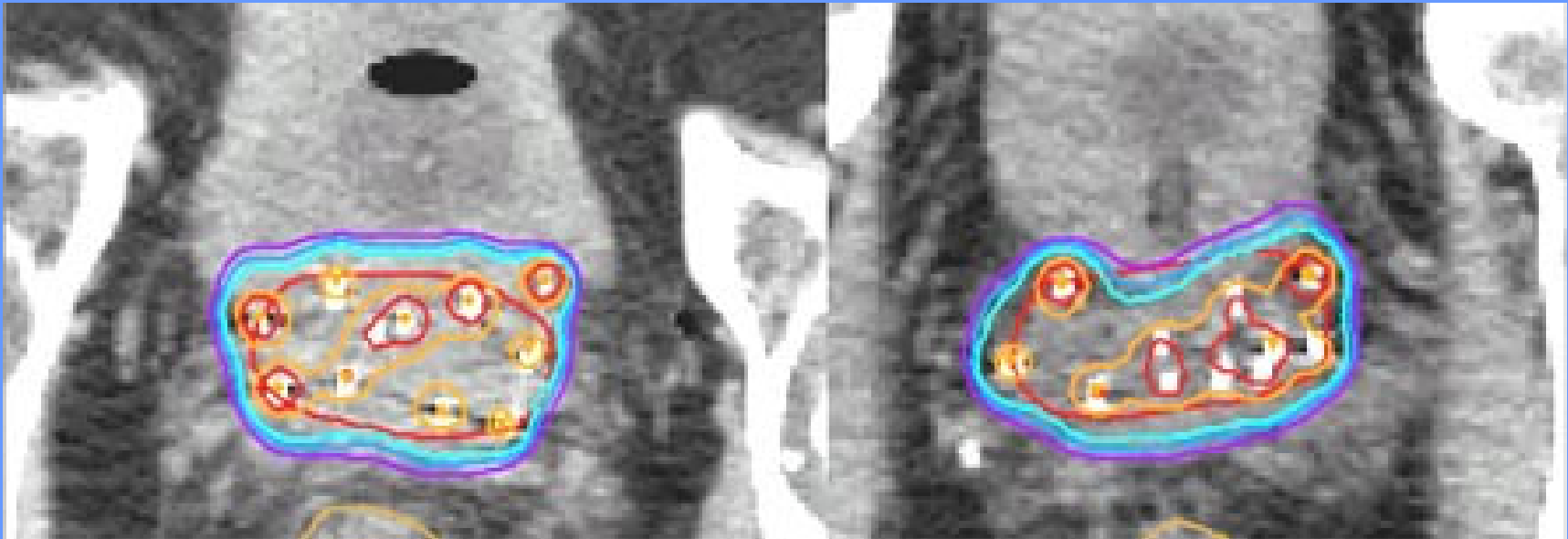


# DAY 0 POST IMPLANT CT "B"

## Implant



# Base Coverage

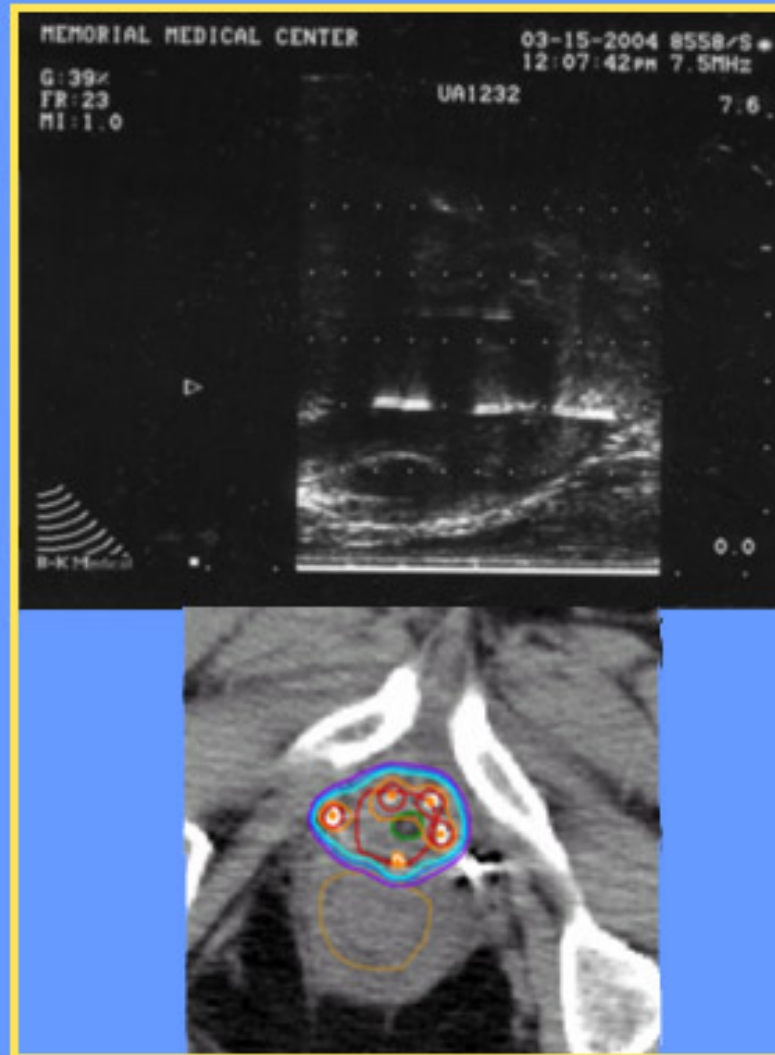


Target Dose/Isodose Levels

145.0 Gy Modify...

Level (Gy)	Level (%)	Color
<input checked="" type="checkbox"/> 290.0	200 %	Red
<input checked="" type="checkbox"/> 217.5	150 %	Orange
<input checked="" type="checkbox"/> 145.0	100 %	Cyan
<input checked="" type="checkbox"/> 130.5	90 %	Blue
<input checked="" type="checkbox"/> 116.0	80 %	Purple

# Seeds placed at apex



# METHODS AND MATERIALS

- 100 consecutive monotherapy patients implanted with I 125 from 1999-2000 at a single institution.

- 1st 40 pts treated with pre-planned modified peripheral loading Mick Technique.-Next 60 pts treated with Hybrid Interactive Mick Technique.

- >>All pts had ultrasound preplan with urinary catheter.

- >>All pts had post implant CT with urinary catheter two hours after implant.

- >>All pts had Day 0 post plan DVH analysis.

Shanahan et al IJROBP 2002 Jun 1;53(2):490-496

# RESULTS

<b>IMPLANT TYPE</b>	<b>US vol</b>	<b>CT vol</b>	<b>mCi/seed</b>	<b>#seeds</b>	<b>total activity</b>	<b>#needles</b>
<b>PREPLAN</b>	<b>33cc</b> (22-52cc)	<b>49cc</b> (26-86cc)	<b>0.30</b> (0.26-0.37mCi)	<b>121</b> (90-66)	<b>36mCi</b> (28.8-46mCi)	<b>32</b> (23-43)
<b>HYBRID INTERACTIVE</b>	<b>37cc</b> (13-63cc)	<b>47cc</b> (23-80cc)	<b>0.34</b> (0.27-0.38mCi)	<b>96</b> (58-61)	<b>32mCi</b> (21-52mCi)	<b>19</b> (13-25) p<.001

**Shanahan et al IJROBP 2002;53(2):490-496**

# DAY 0 CT RESULTS

IMPLANT TYPE	planning time	procedure time	D90	V100	V150
PREPLAN	32 min	90min	132Gy (118-185Gy)	86% (81-99%)	51% (24-78%)
HYBRID INTERACTIVE	7min (p<.001)	40min (p<.001)	149Gy (133-189Gy)	91% (81-99%)	38% (17-75%)

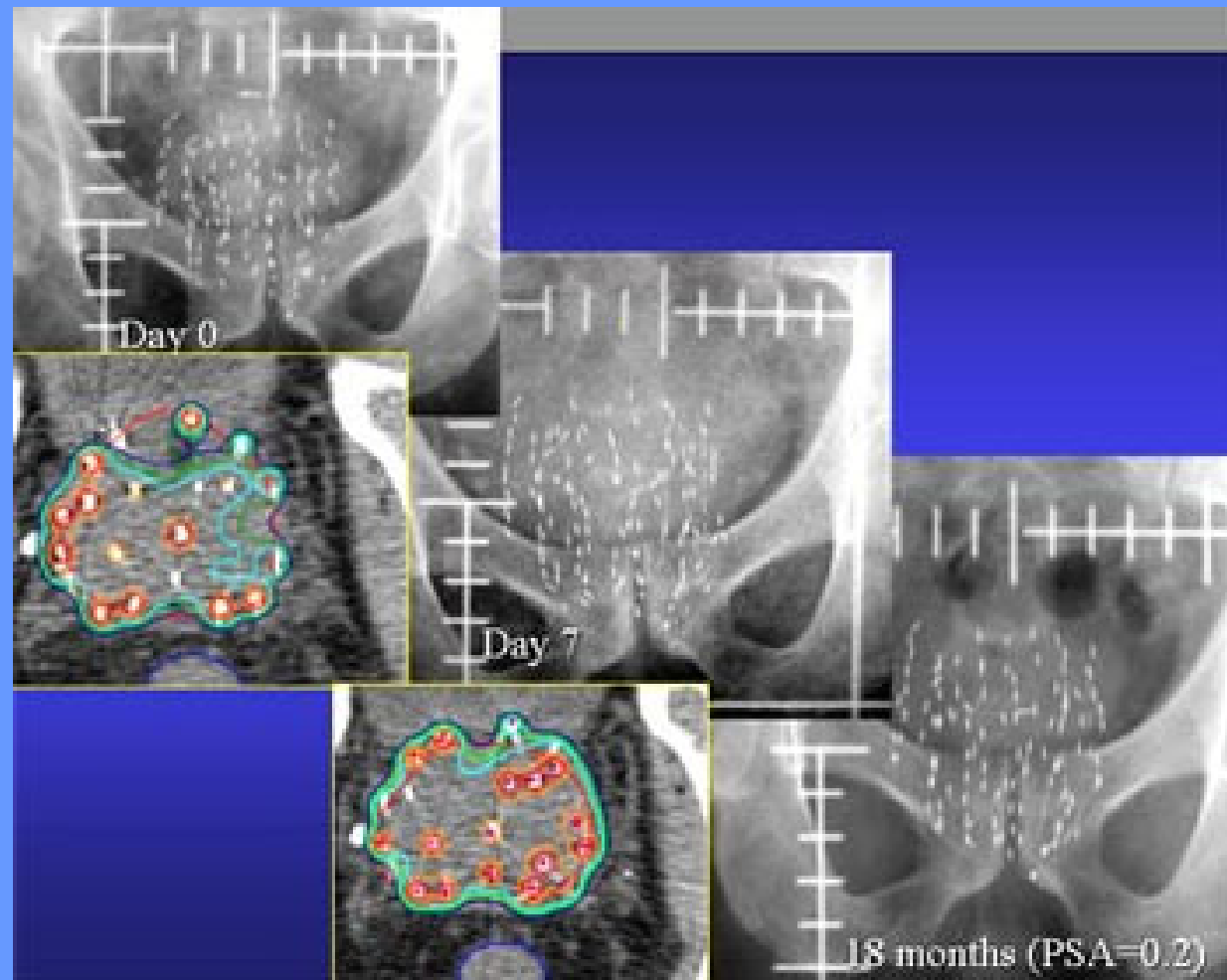
Shanahan et al IJROBP 2002;53(2):490-496

# Next...

**333 consecutive monotherapy patients implanted with I 125 from 9/00-11/03 at a single institution.**

- **Teaching hospital, 1 rad onc (T.S.) working with 10 urologists.(urology residency program)**
- **All pts. treated with Hybrid Interactive Mick Technique(Grado technique).**
- **Dose prescribed: 145Gy**
  - .>>**All pts had pre-op ultrasound volume study**
  - .>> **All pts had post implant CT with Foley catheter two hours after implant.**
  - >> **All pts had Day 0 post-plan DVH analysis.**

# SUBOPTIMAL IMPLANT - correction





# SEED MIGRATION Patients(%)

	LUNGS	BLADDER
Shanahan	18 %	2%
Tapen	5.9 %	n/a
Ankem	36 %	n/a
Older	29 %	n/a
Stutz	n/a	29.7%
Davis	55 %	n/a
Prestidge-survey	n/a	31%
Merrick	22 %	n/a
Nag	18 %	n/a
Chen	24 %	n/a
Stock and Stone		1%

# MICK TECHNIQUE

- **Fast, reproducible implants**
- .• **Allows for use of image guidance.**
- **Optimized seed placement accounts for edema.**
- **Decreased staff preparation time**
- .• **Adaptable for future brachytherapy needs.**

