

**Prostate Brachytherapy
Mick Applicator
Image Guided Techniques
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PROSTATE BRACHYTHERAPY

Preloaded Needles

- **Preplan Technique**

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

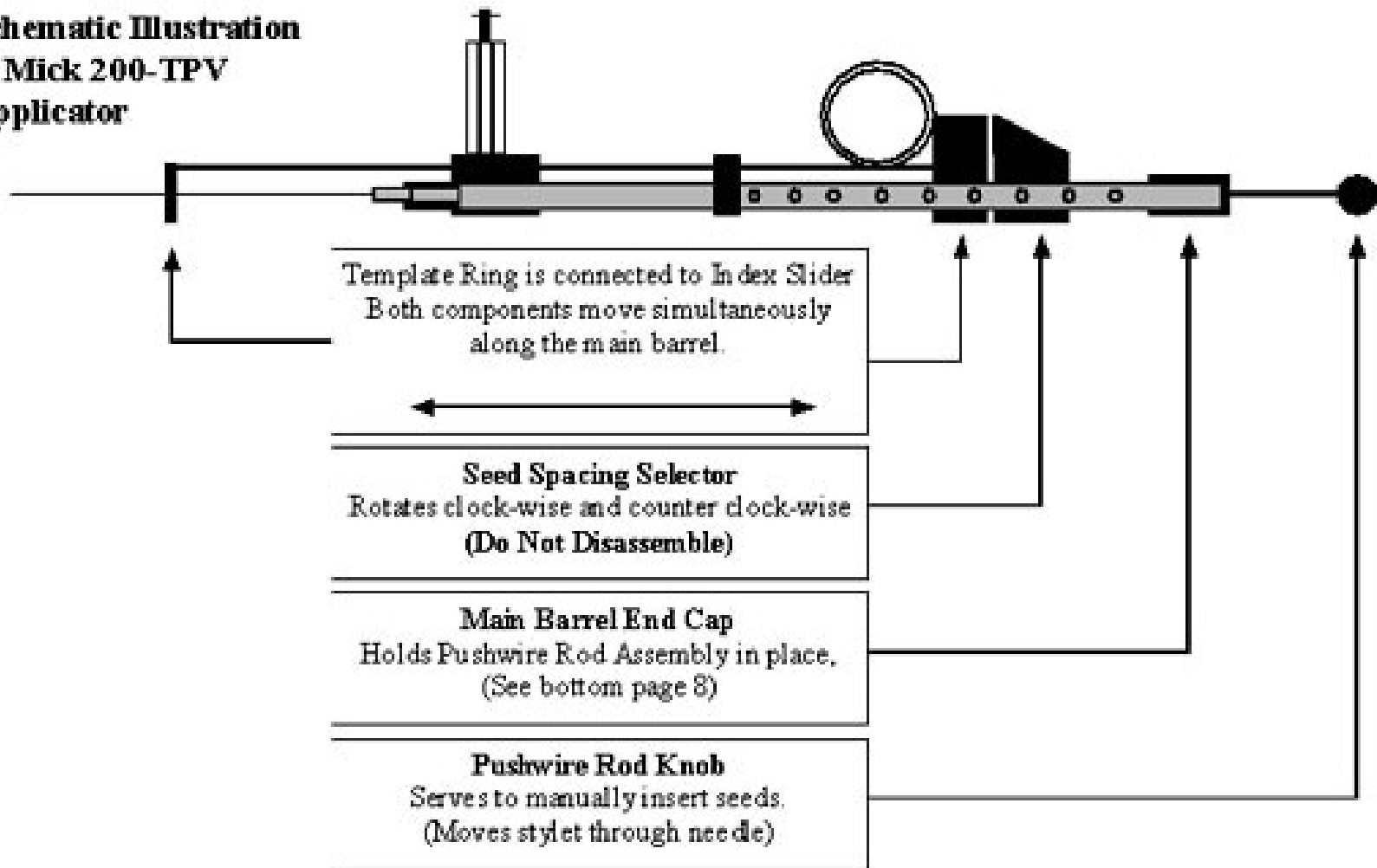
MICK 200-TPV APPLICATOR

- 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



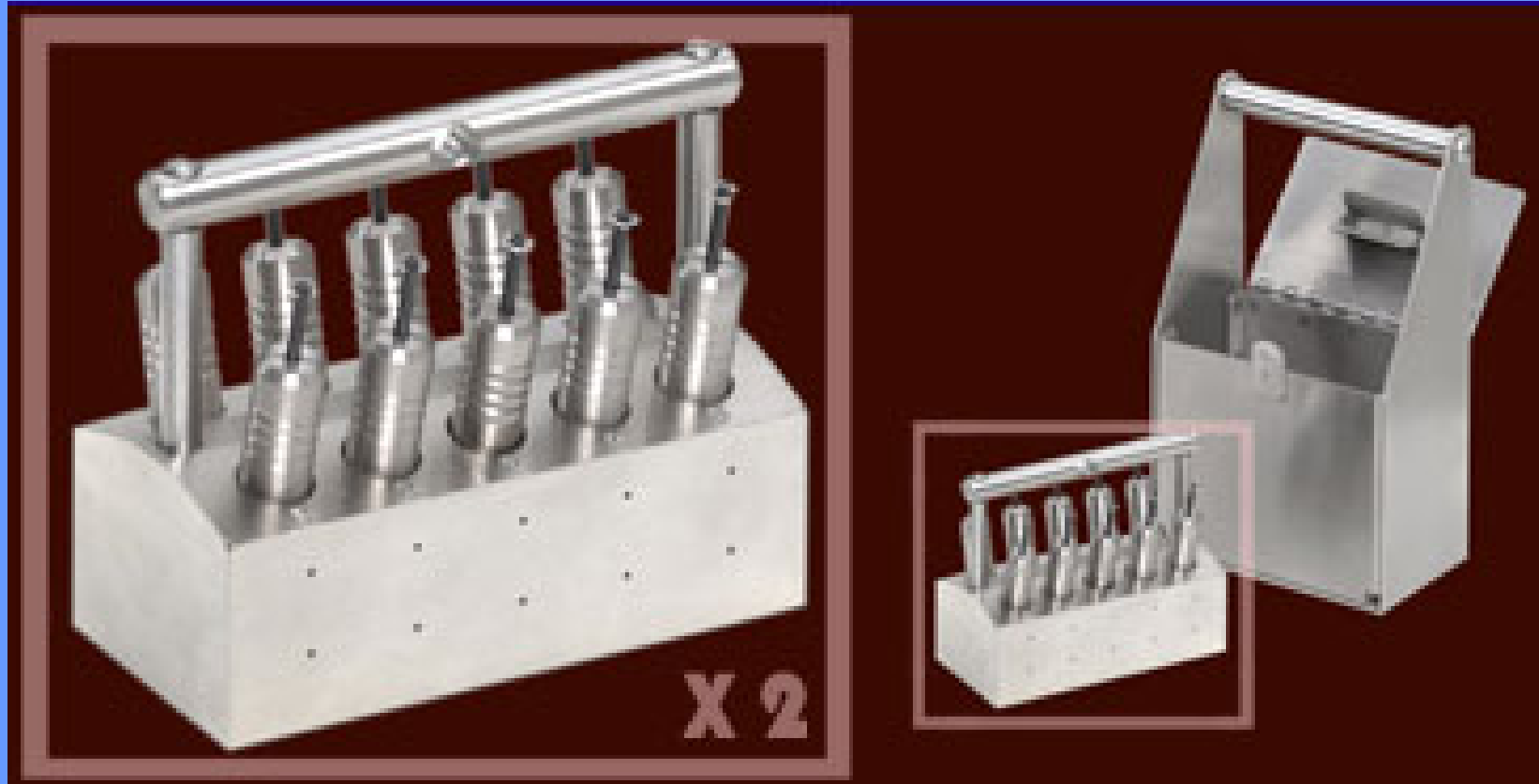
**Most implant needles are disposable and shipped sterile.
Mick needles are available both 17 and 18 gauge.**

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”.**

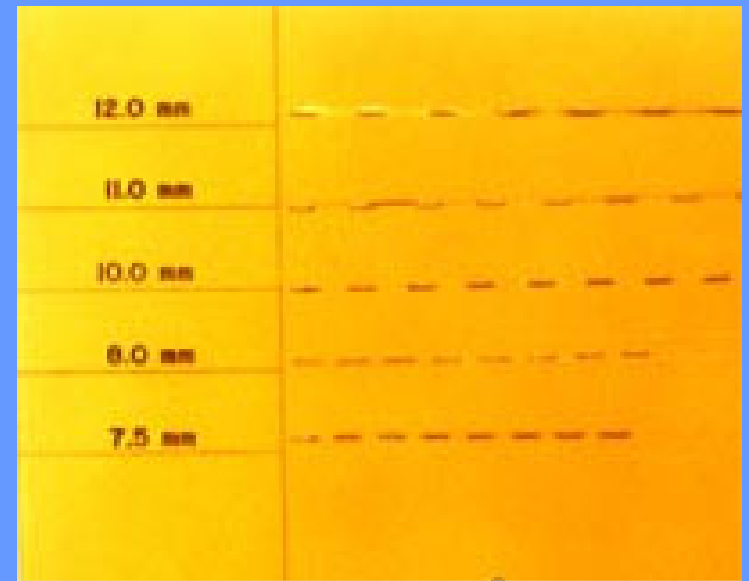


Image Guided Seed Placement

- **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%**

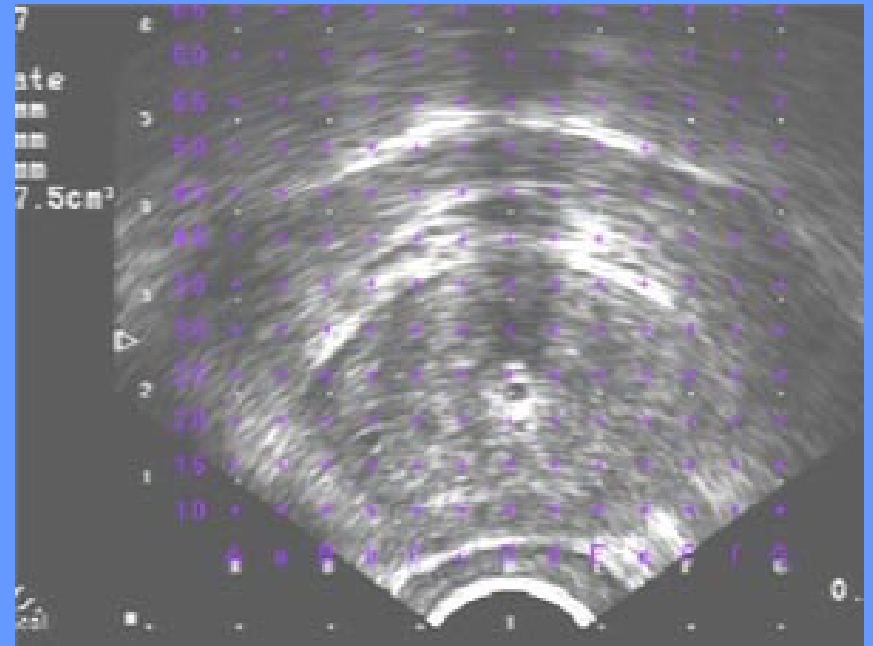
 - Edema**

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

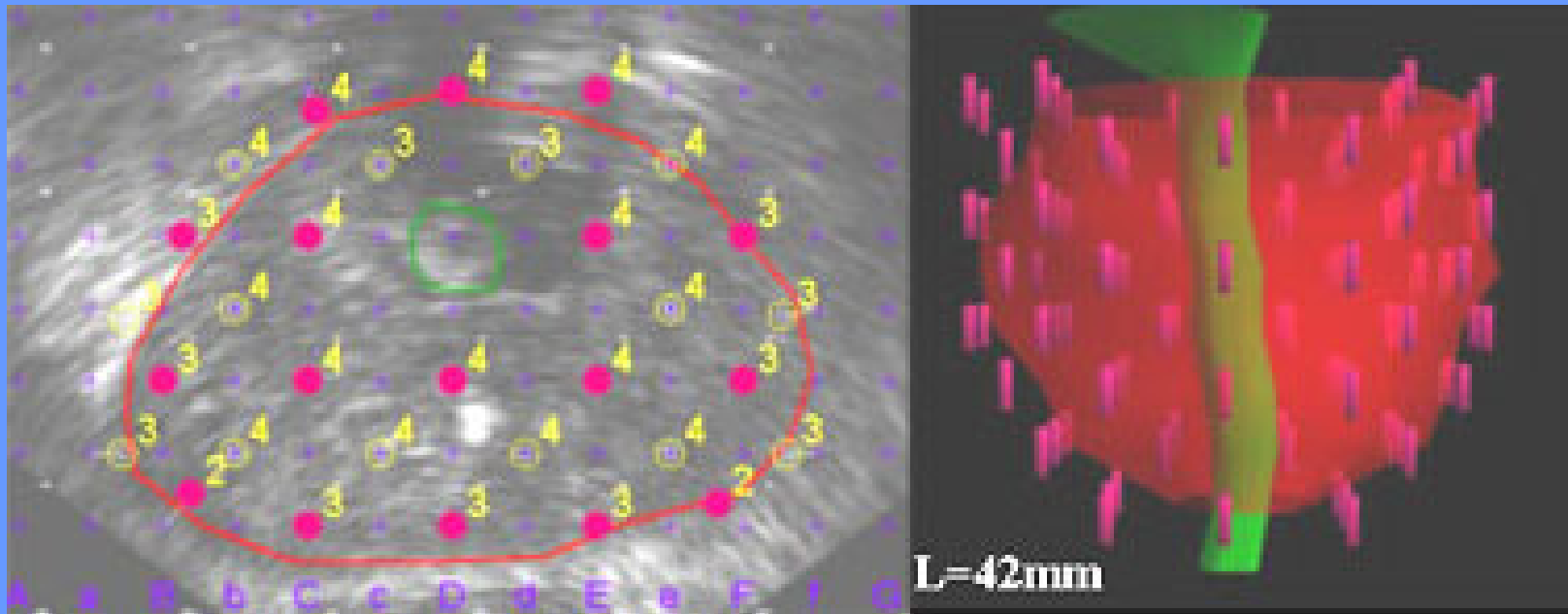
- **Size and shape.**
- **Urethra location.**
- **Number and activity of seeds.**
- **Size and shape of TURP defect.**
- **Median lobe.**



Traditional Preplan

Assumes either:

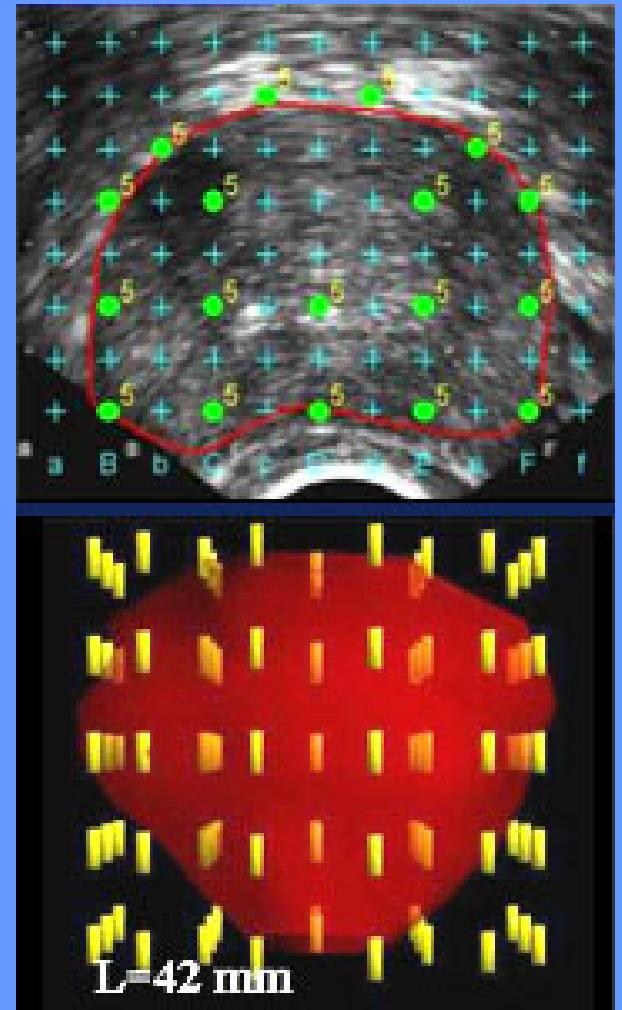
- 1) prostate doesn't move, change shape, or swell during implant; or**
- 2) planners can accurately predict amount of edema.**



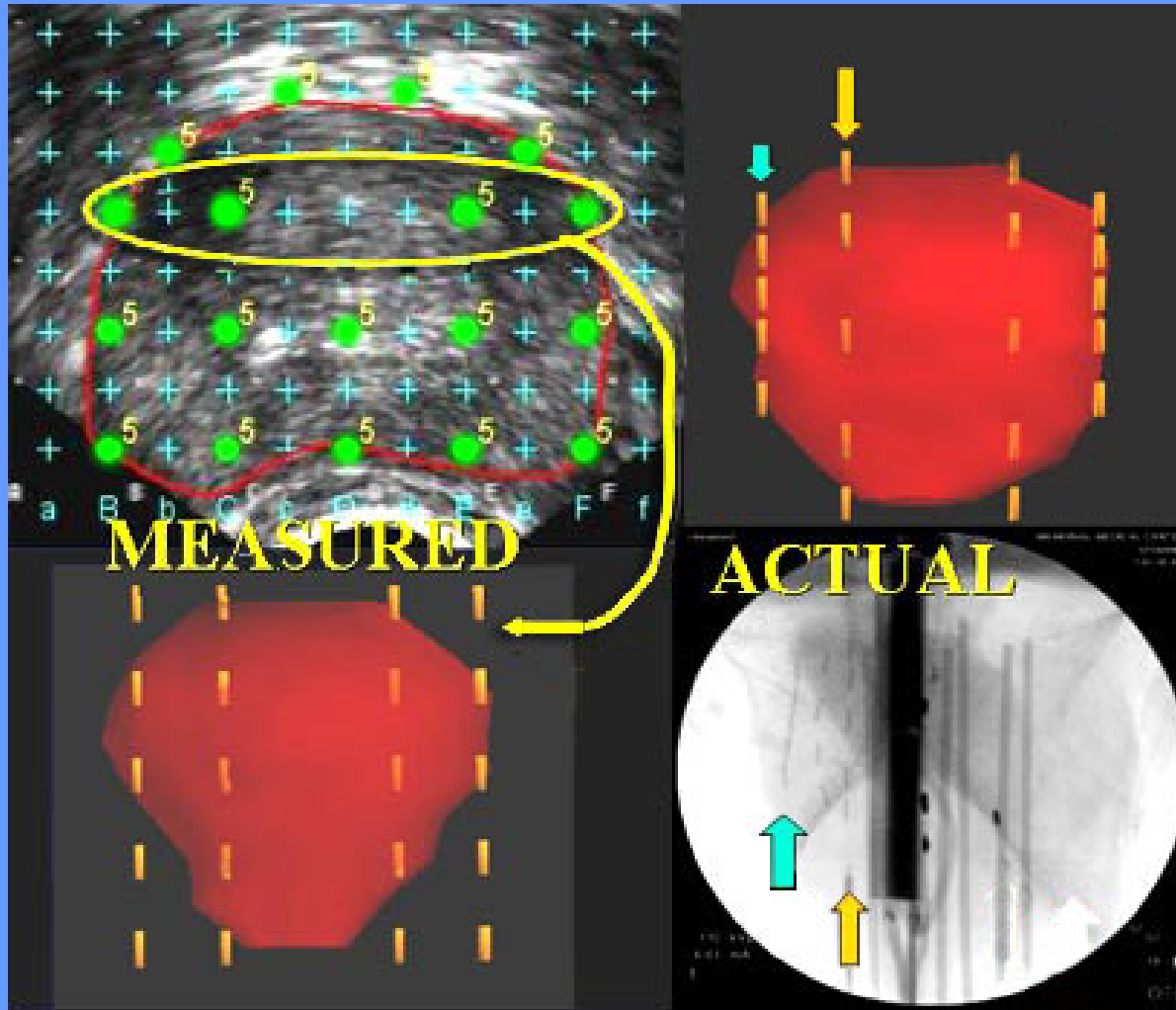
HYBRID INTERACTIVE PRE-PLANNING

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**

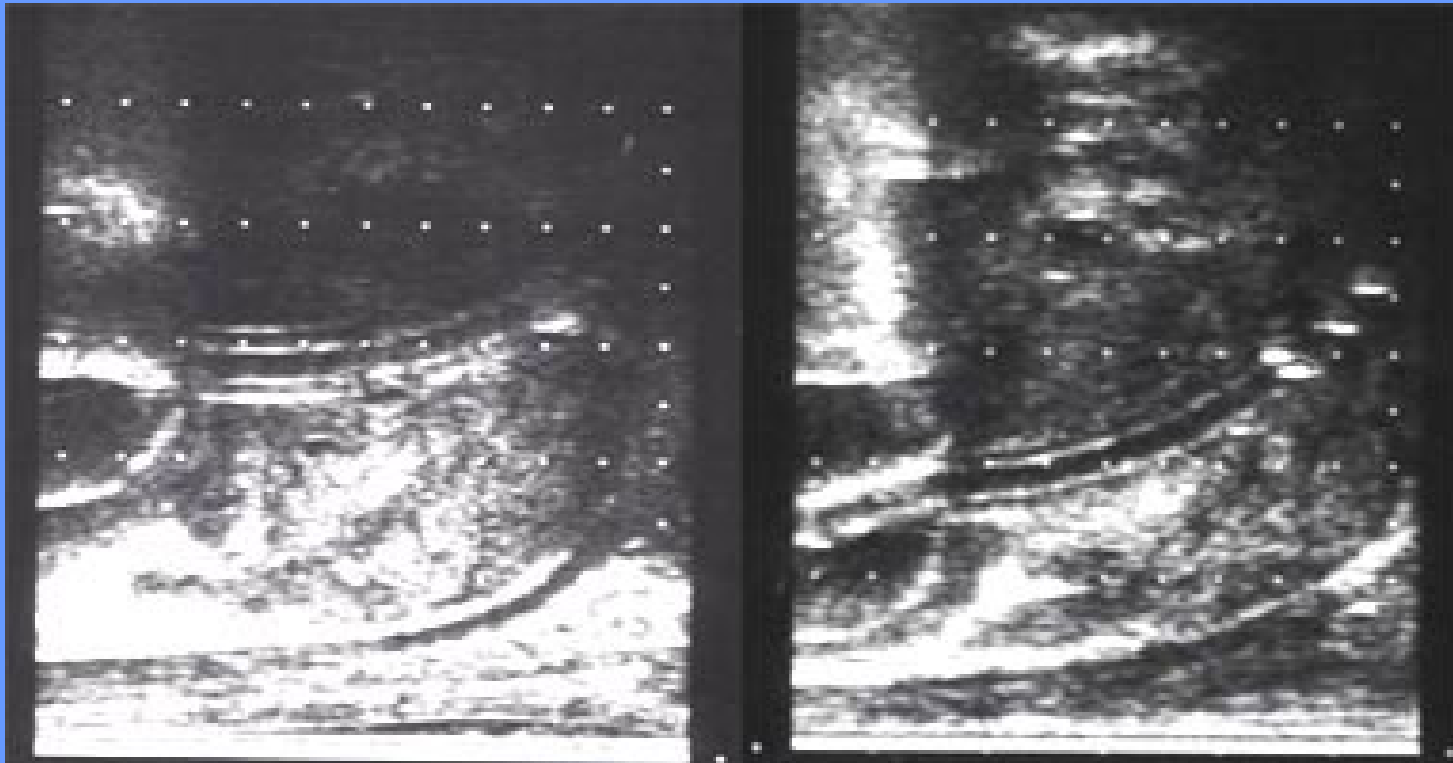


PREPARING THE PATIENT

- **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?



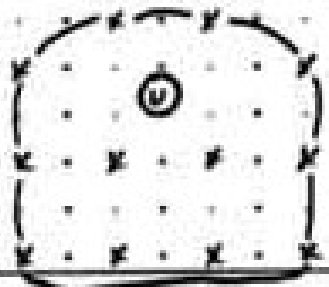
INTRA-OP GUIDE

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

Radiation Oncologist:		Urologist:	
CS:	PSA:	Radiation Oncologist:	Urologist:
GS:	Tumor Loc:	CS:	PSA:
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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

EX. #2 WIDEST CUT OF GLAND

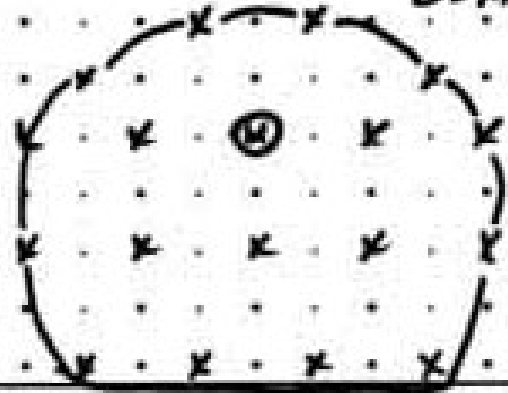
LENGTH = 4 SEEDS PER NEEDLE



LENGTH = 4.5 SEEDS/NEEDLE = 6

ACTIVITY PER SEED = 35 - 2.375

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.

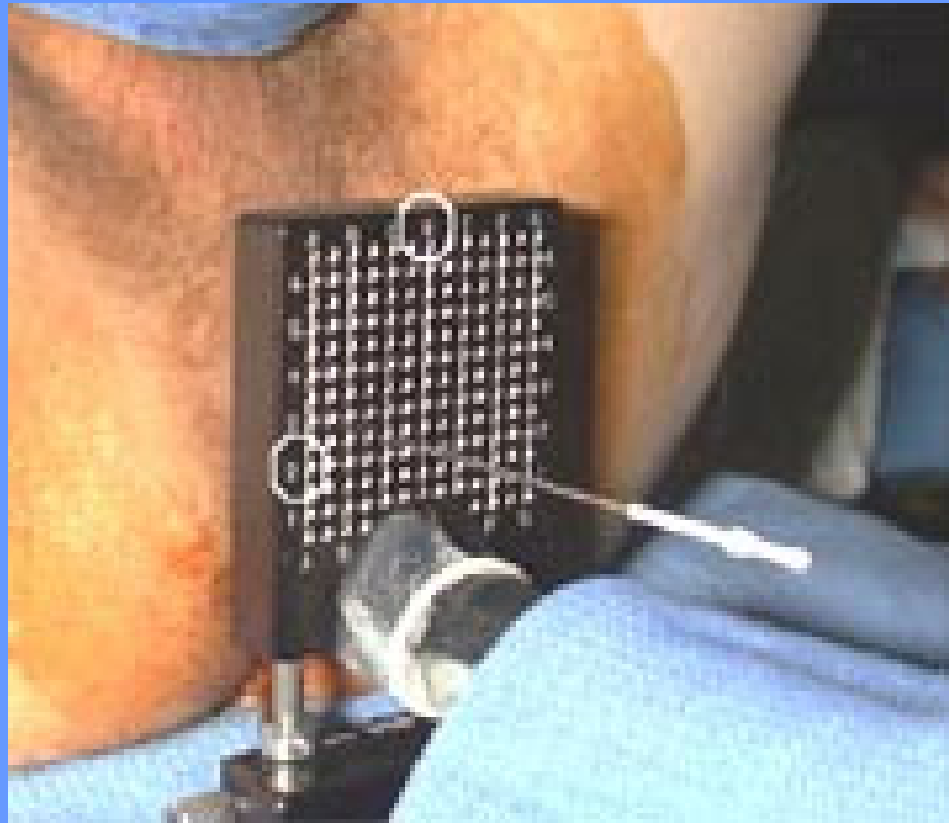


FIDUCIAL GOLD APEX MARKER

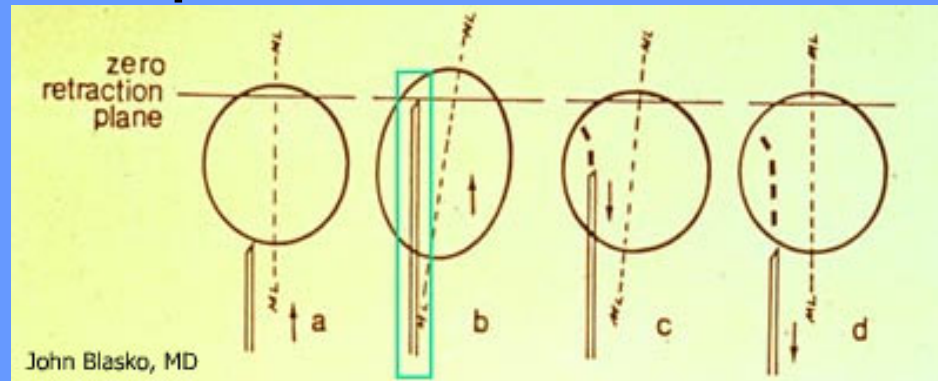
- Placed at beginning of procedure using ultrasound guidance
- Allows verification of apex coverage and assurance that penile bulb or membranous urethra does not get implanted.
- Excellent visual correlation between ultrasound, fluoroscopy, and CT.



GLAND IMMOBILIZATION



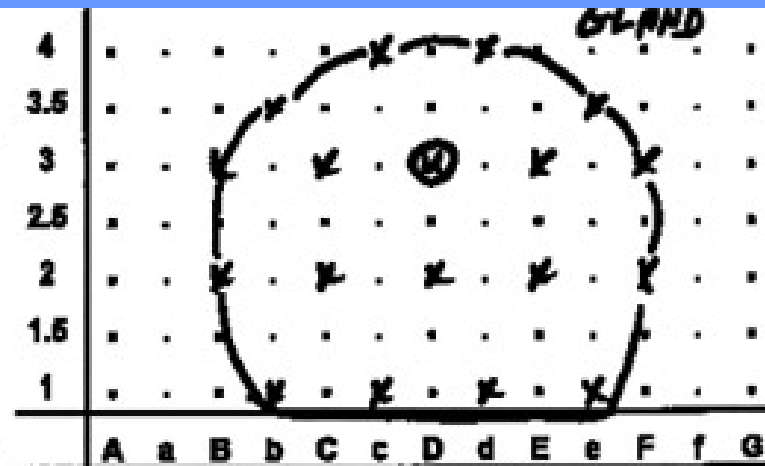
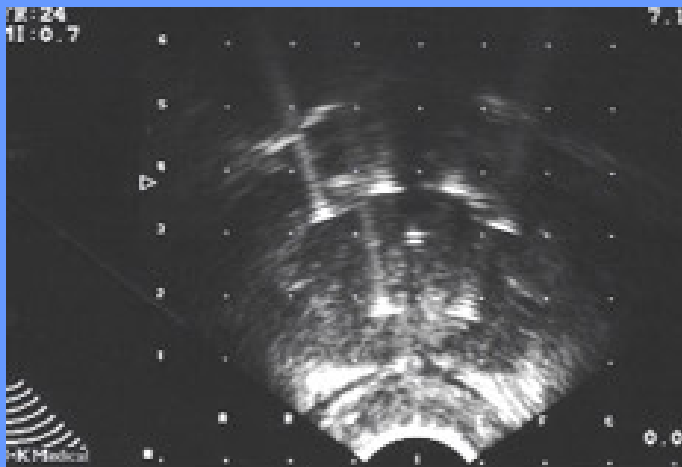
Rotational effect from Insertion of Lateral Needles and Resulting Coverage Gaps at Prostate Base



- 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

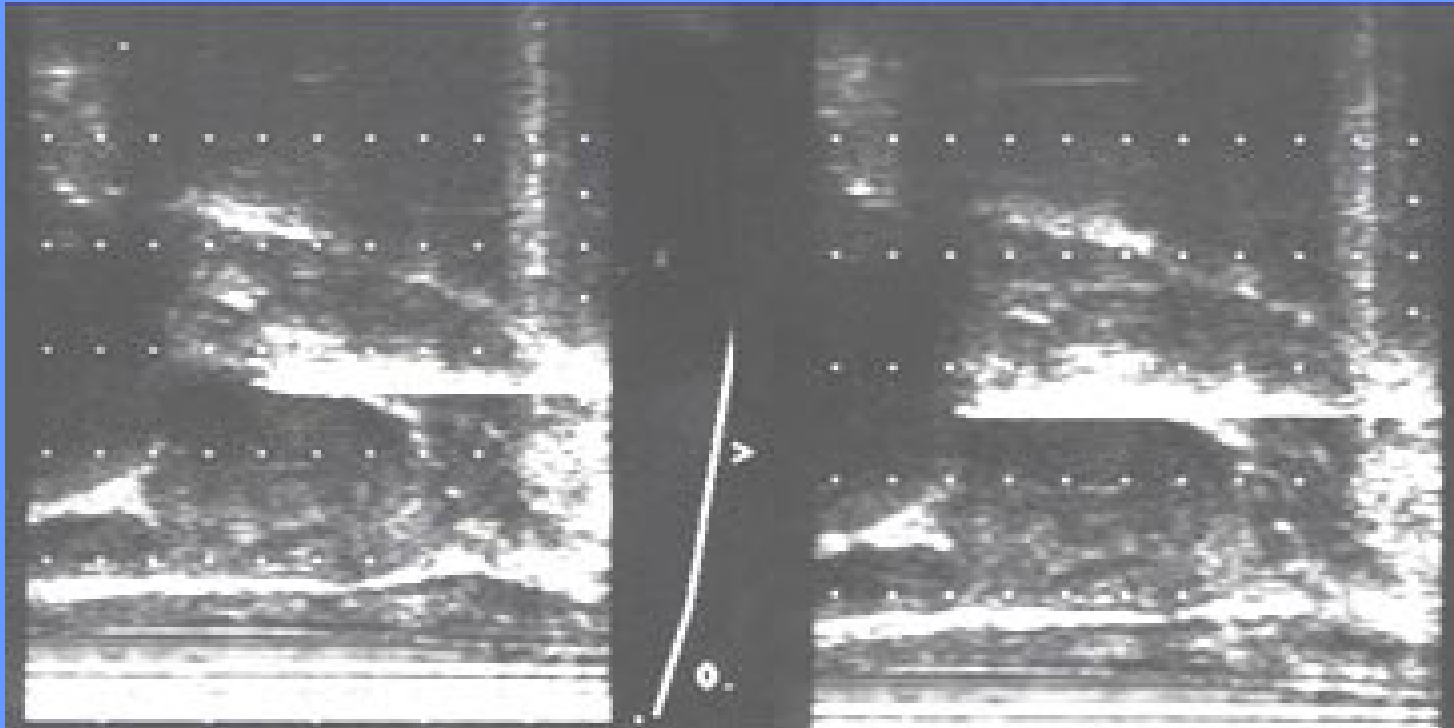


NEEDLE PLACEMENT

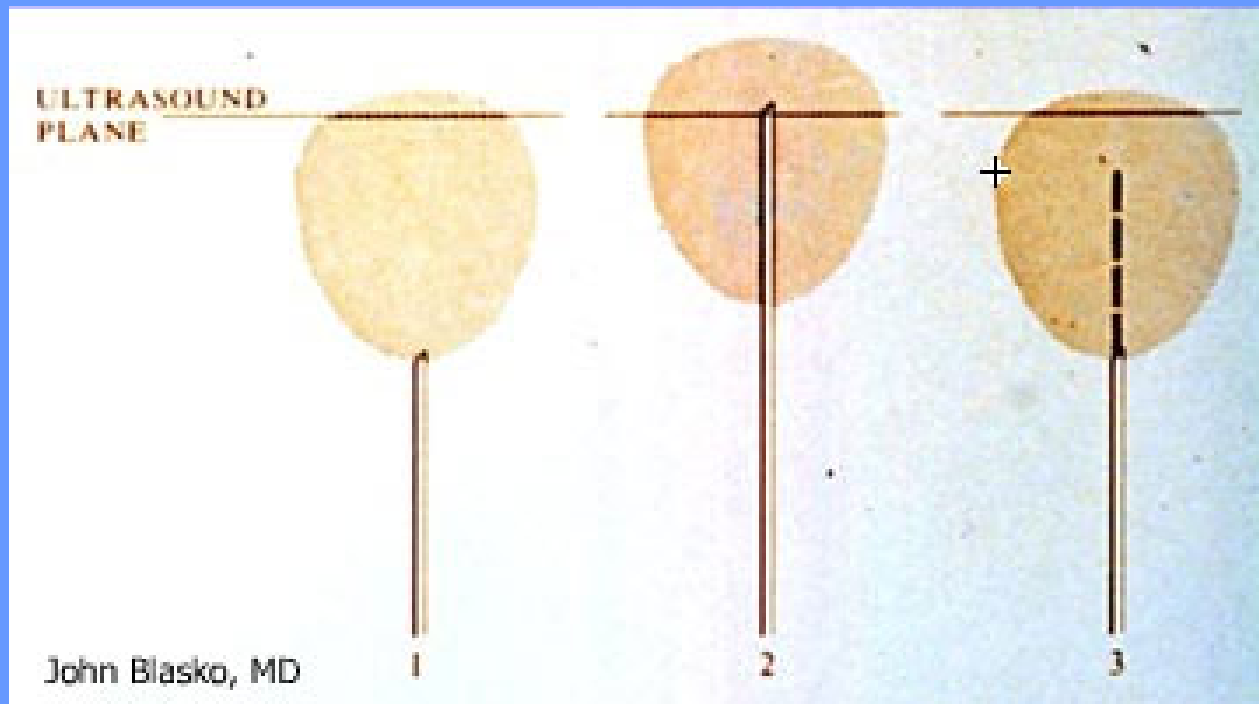
- **Depth of each needle determined and confirmed by sag. ultrasound.**
- **Accurate needle placement improves seed implantation.**



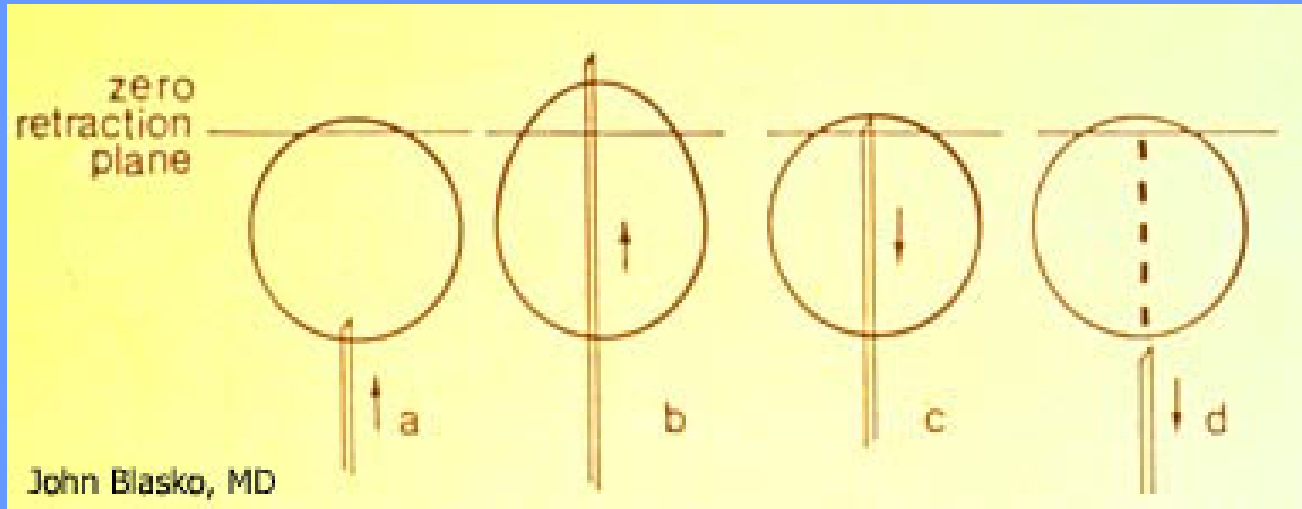
Sag. Ultrasound



Prostate Superior Displacement "Needle Tenting Effect"



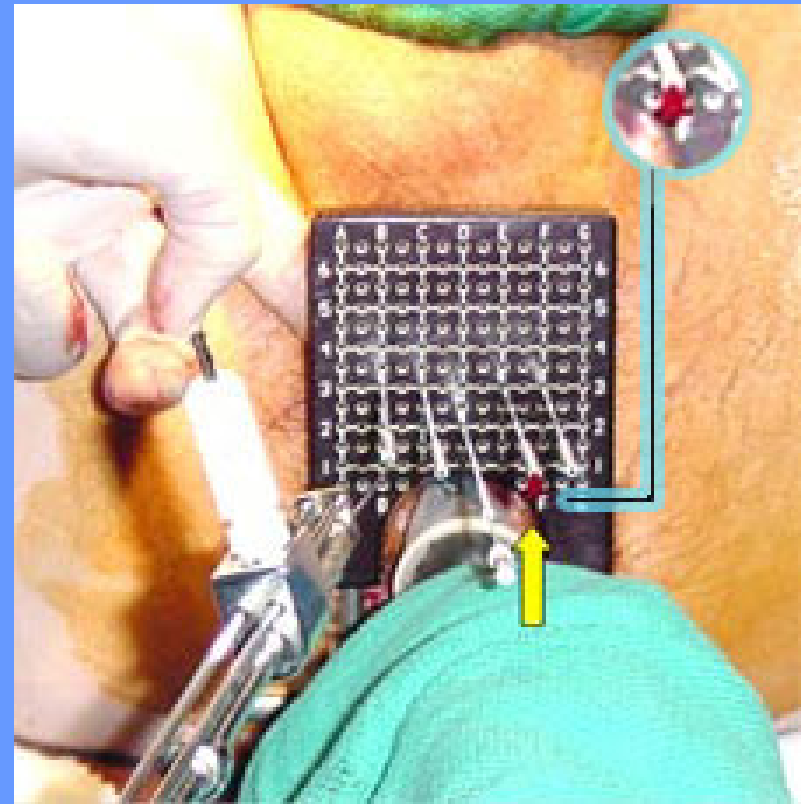
Technique to Correct for "Tenting Effect"



- 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



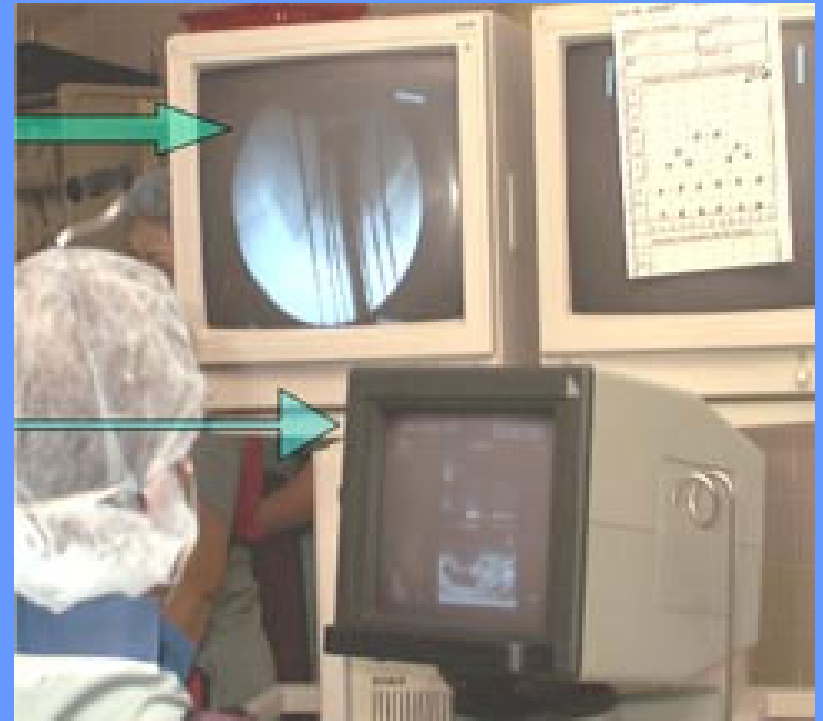
TEAM APPROACH

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

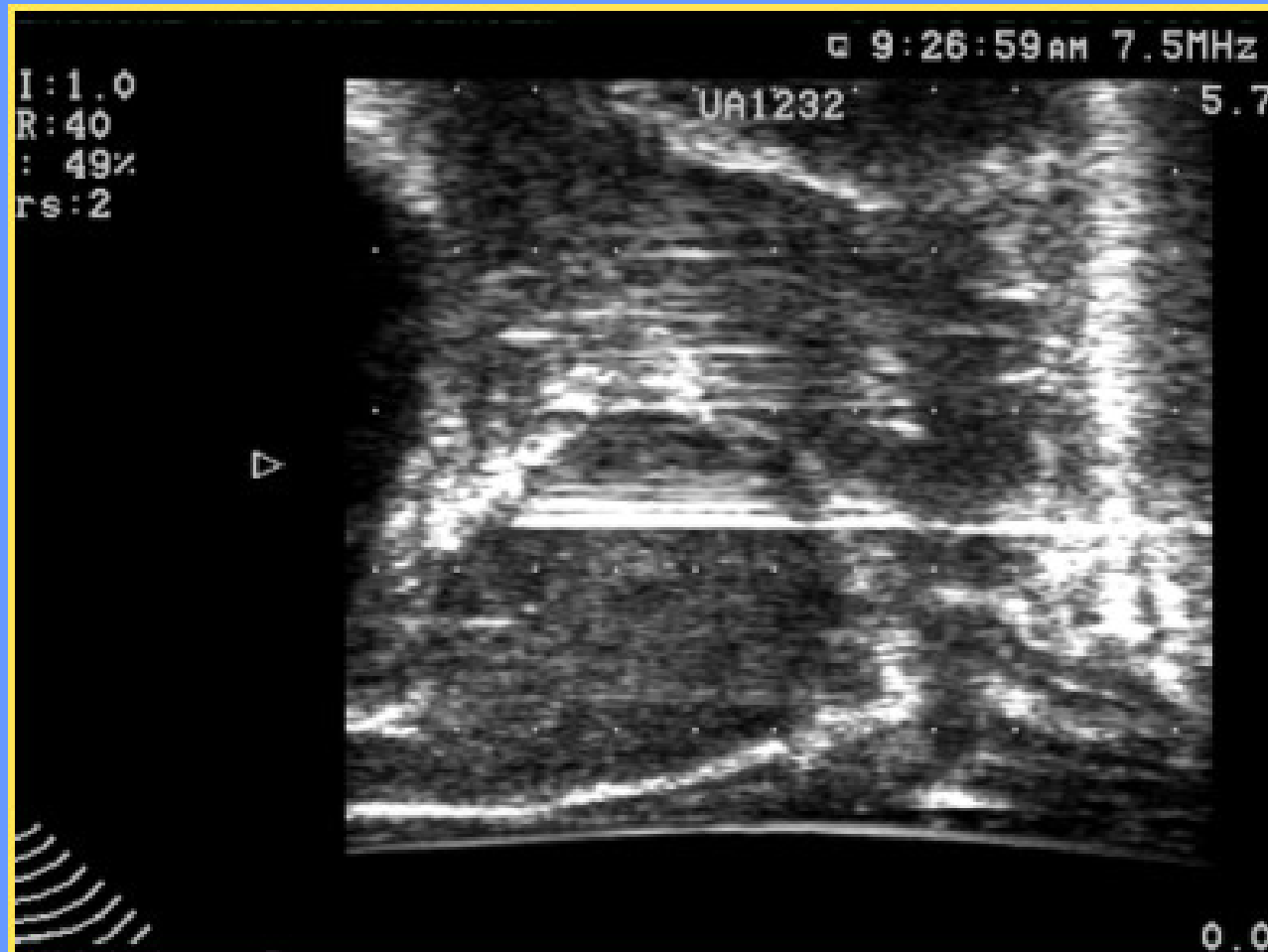


IMAGE GUIDED SEED PLACEMENT

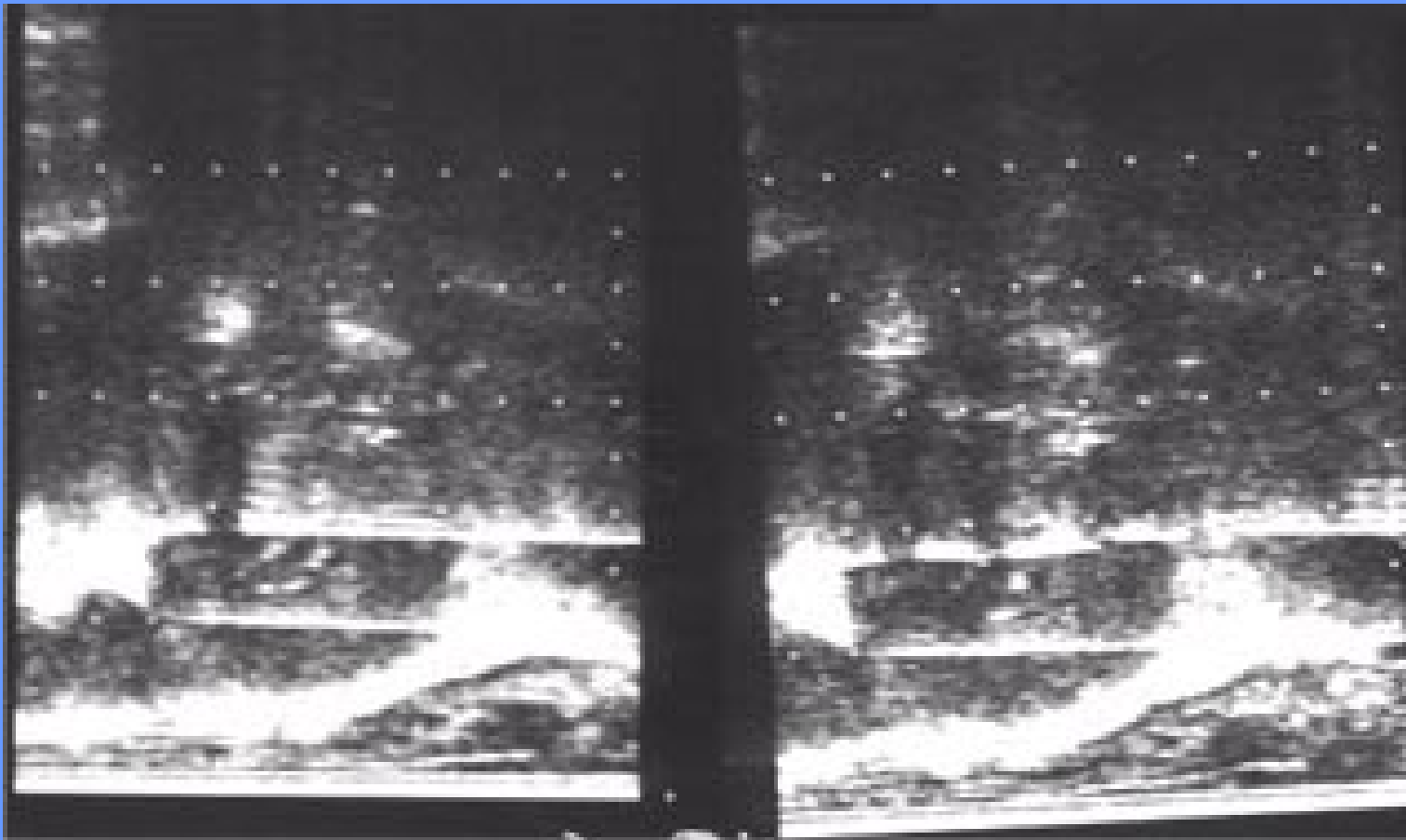
- Direct visualization of needles, seeds, and gold apex marker with fluoroscopy.
- Direct visualization of prostate, needles, and seeds with ultrasound.
- Real time visualized placement ensures coverage of entire prostate



Create Pocket for 1st Seed

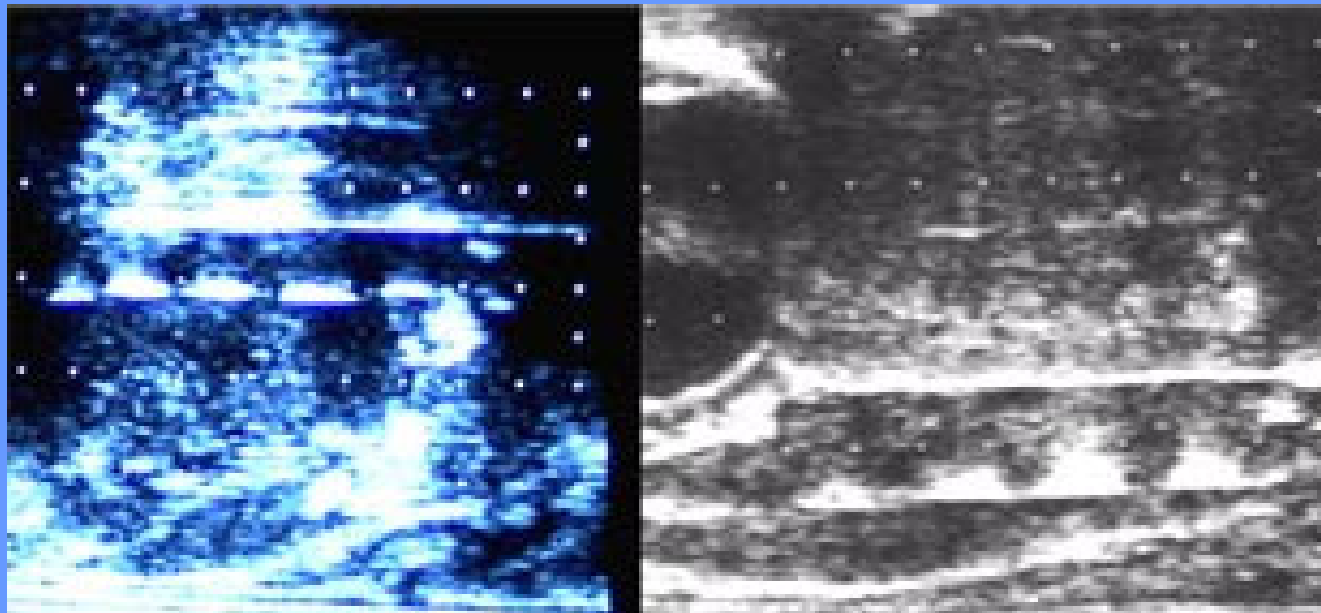


SEEDS DROPPING



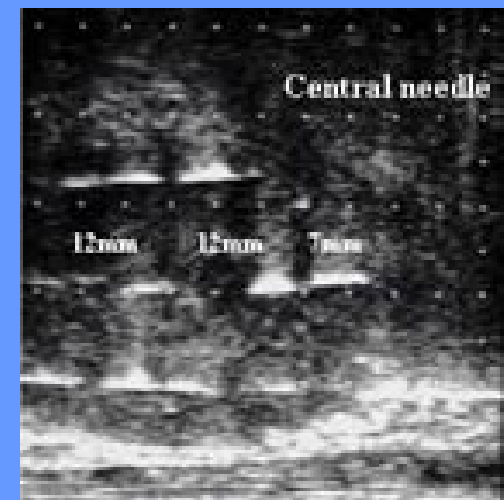
SEED PLACEMENT

Rotating the Sled

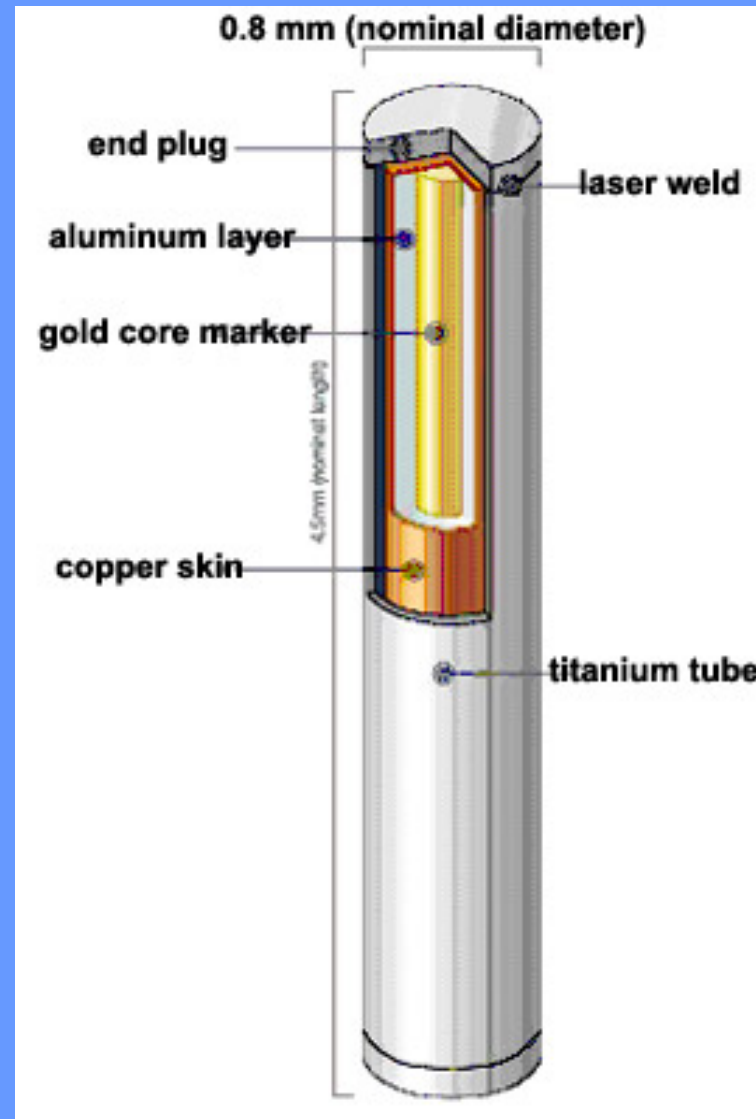


SAGITTAL ULTRASOUND

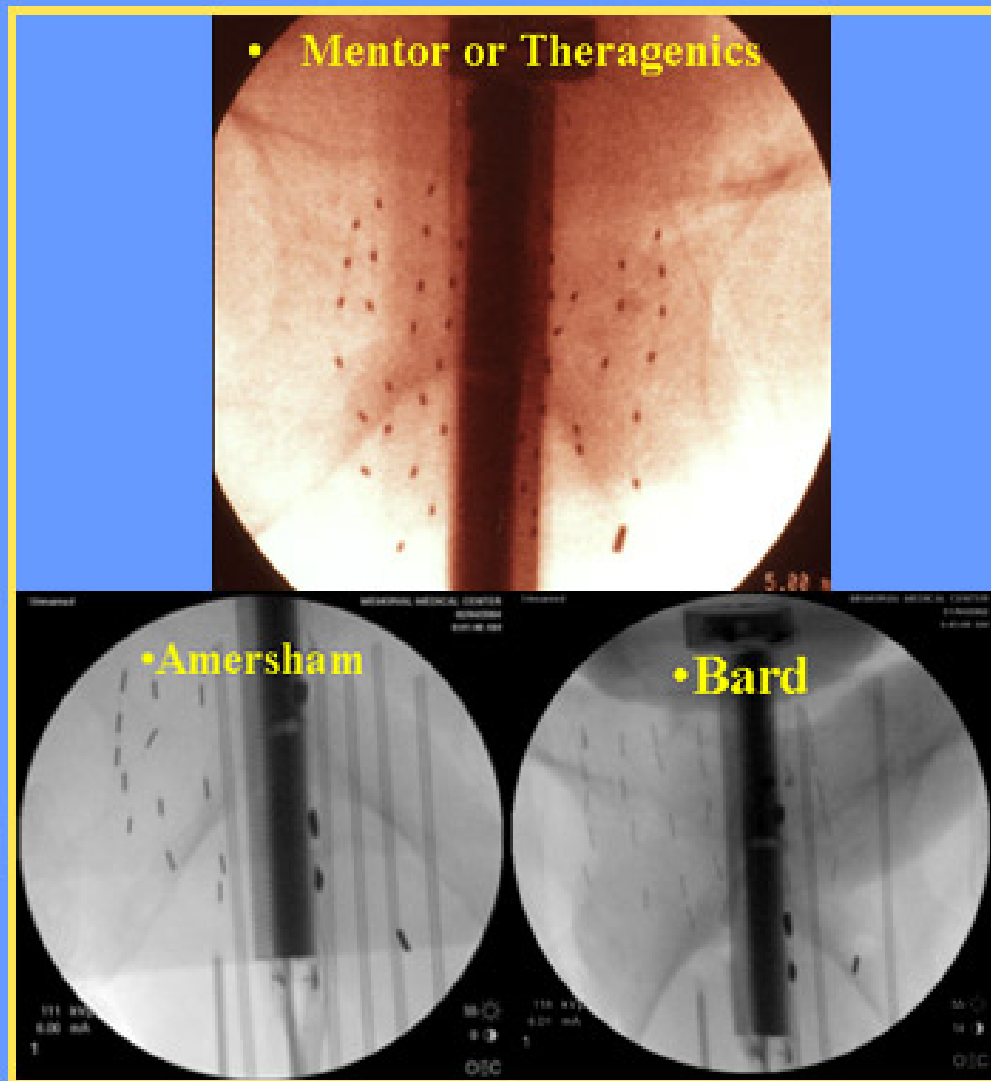
- The key to successful interactive placement of seeds.
- First and last seeds placed through capsule.
- Seed to seed separation clearly measurable and visible.



MARKER IN SEEDS



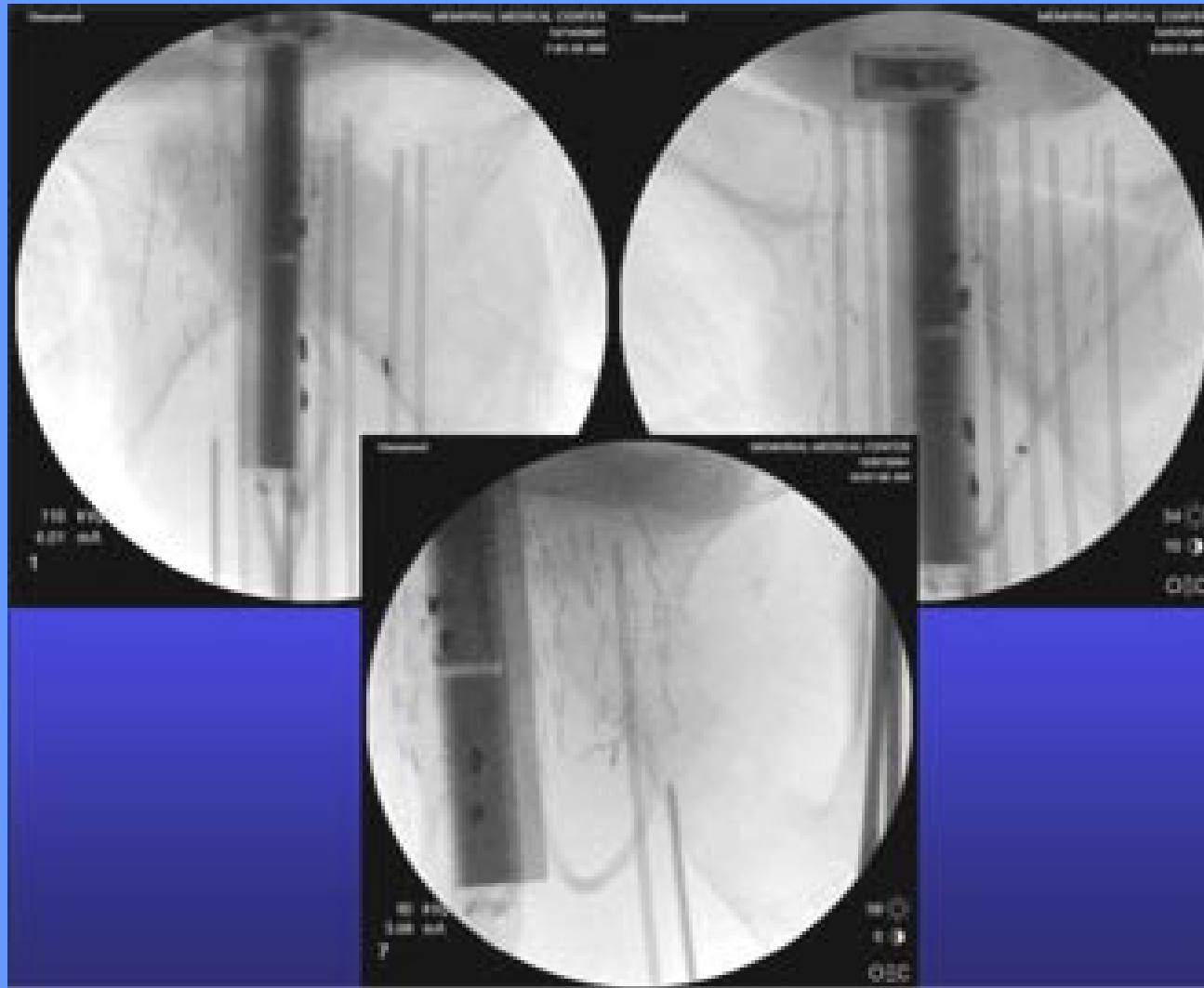
FLUOROSCOPY



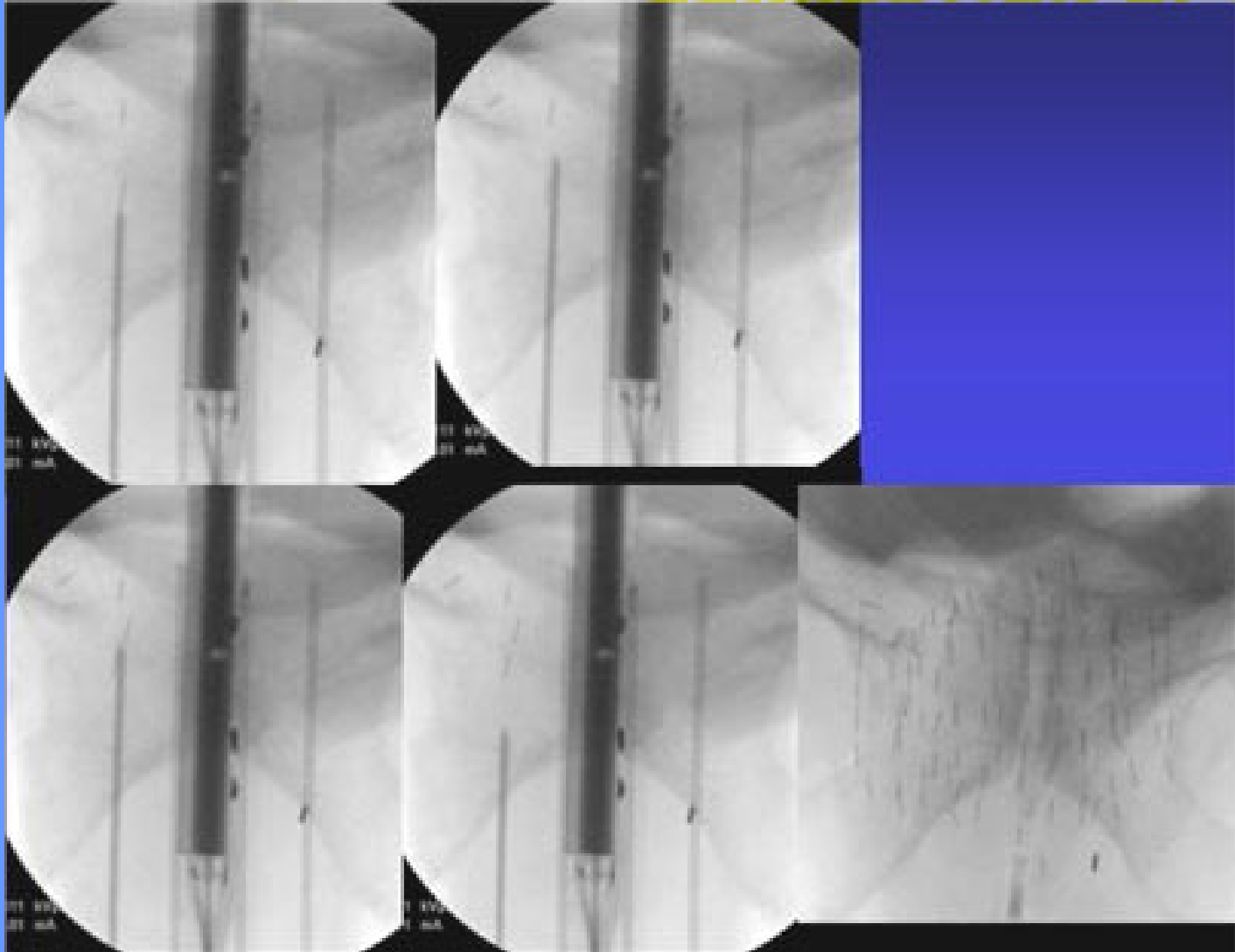
Variable spacing on fluoroscopy



Fluoroscopic assist



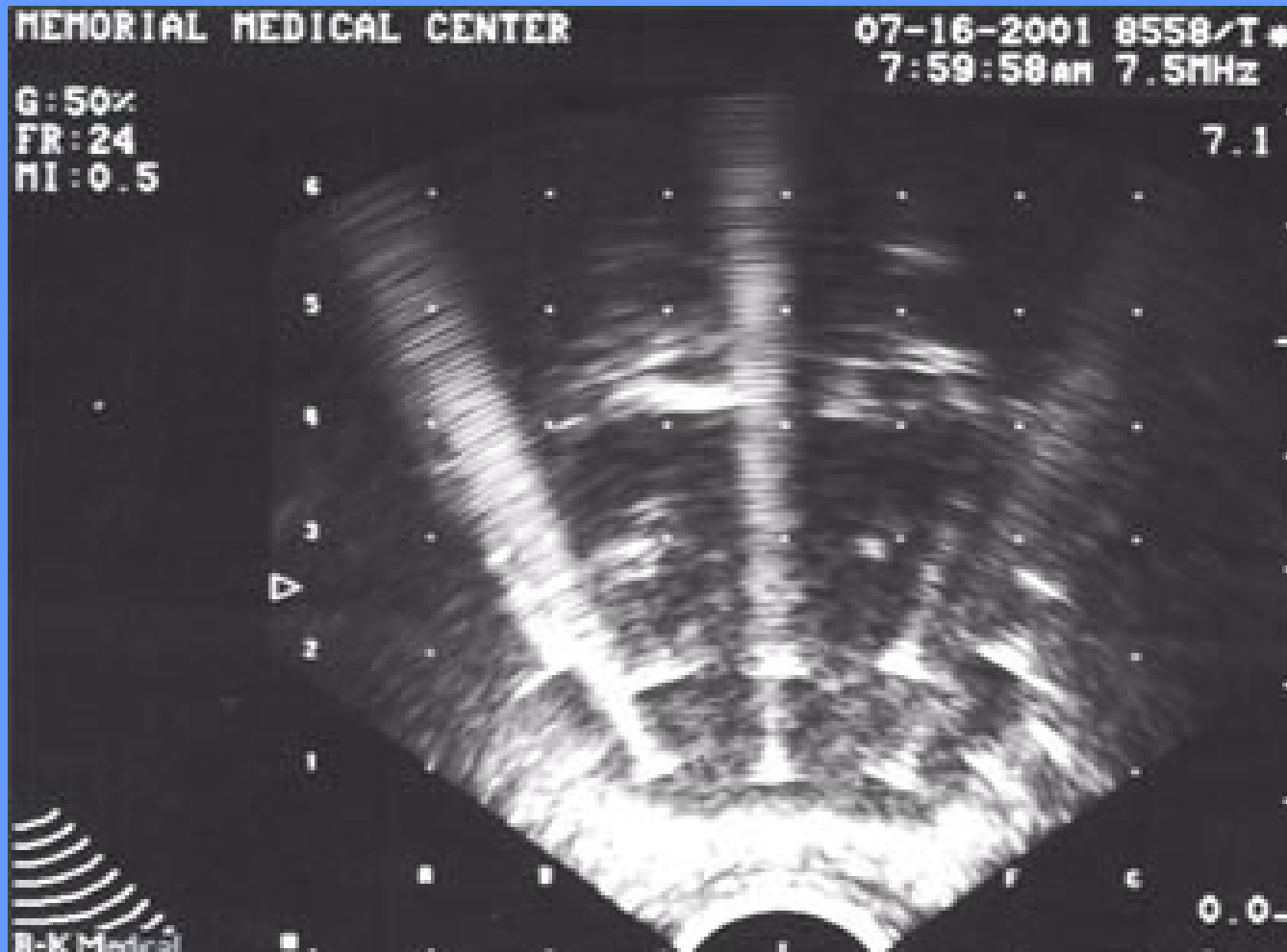
CORRECTION OF SEED MIGRATION



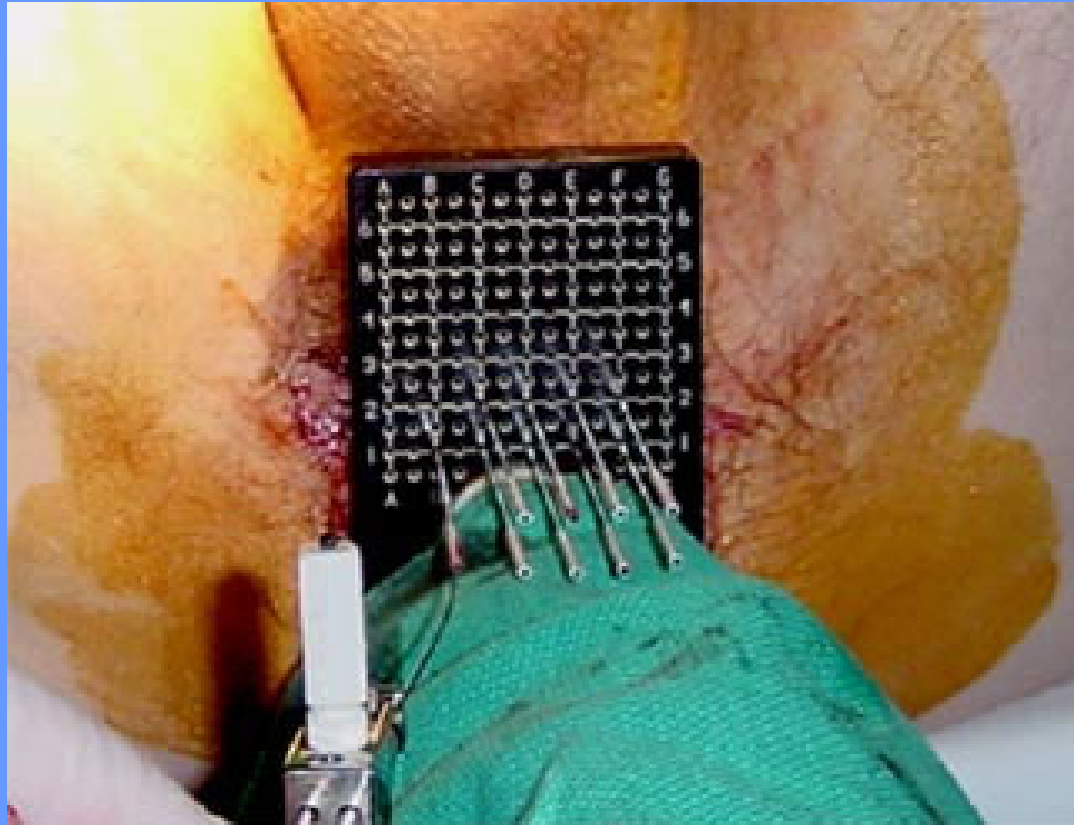
NEEDLE PLACEMENT



LAST TWO ROWS



LAST TWO ROWS



“POOR MAN’S CYSTO”

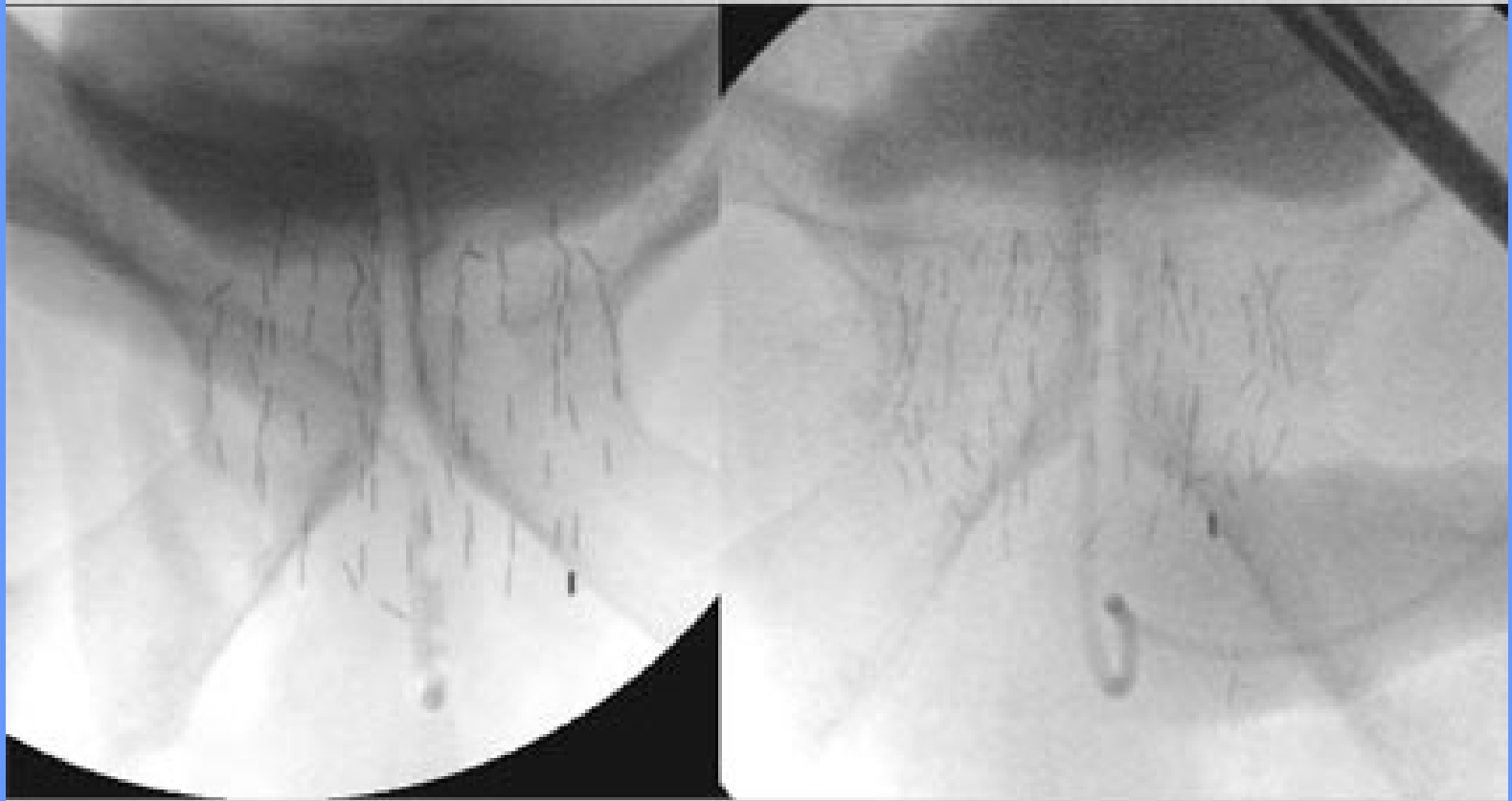
- 1) Advance Foley catheter to hilt and retract 2 times
- 2) Check fluoro of bladder for seeds
- 3) Open Foley clamp to drain urine.
- 4) If clear urine and no seeds in bladder, no cysto needed.



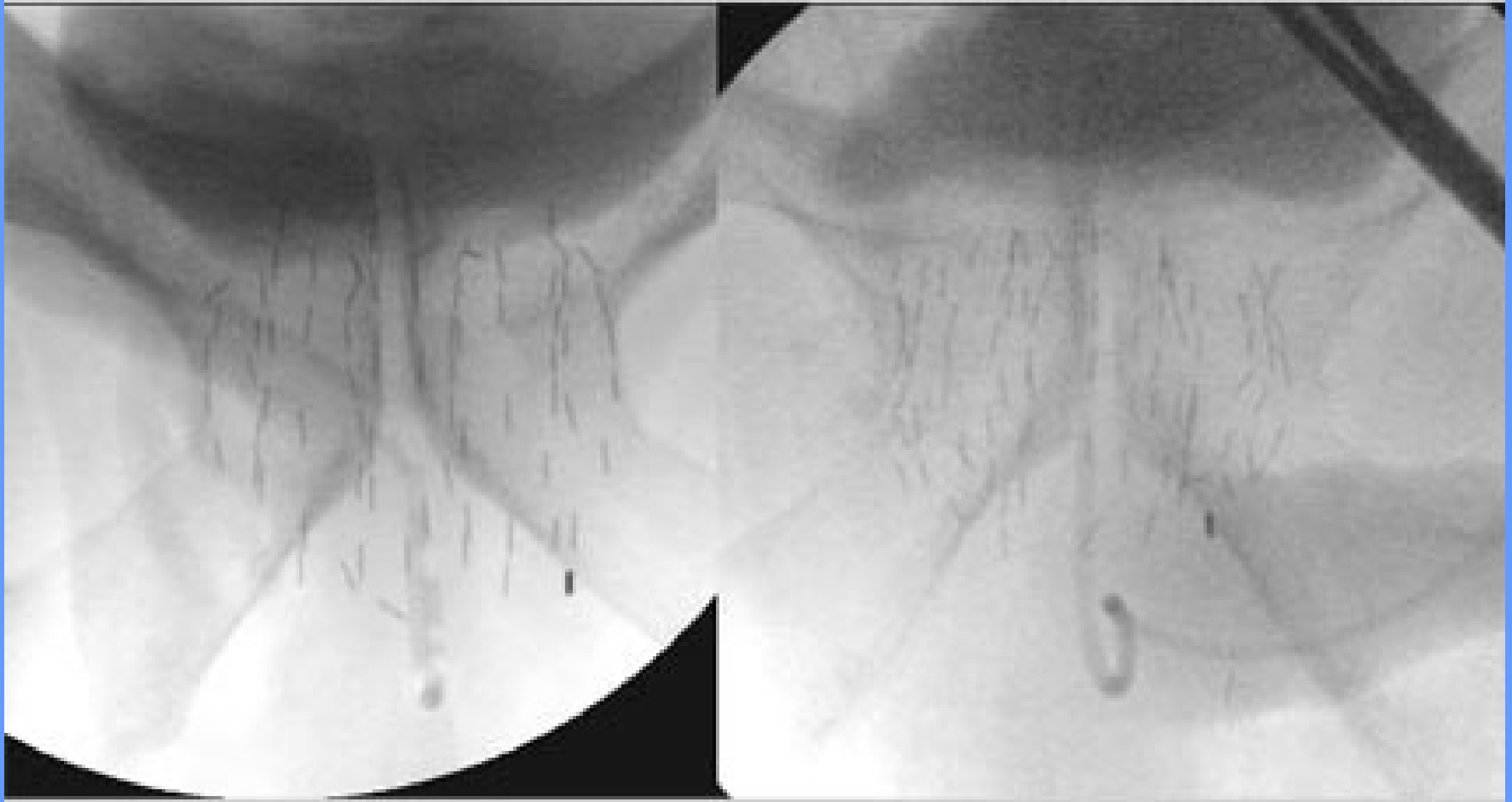
Seed Migration in Bladder



“Seed waking” migration below prostate



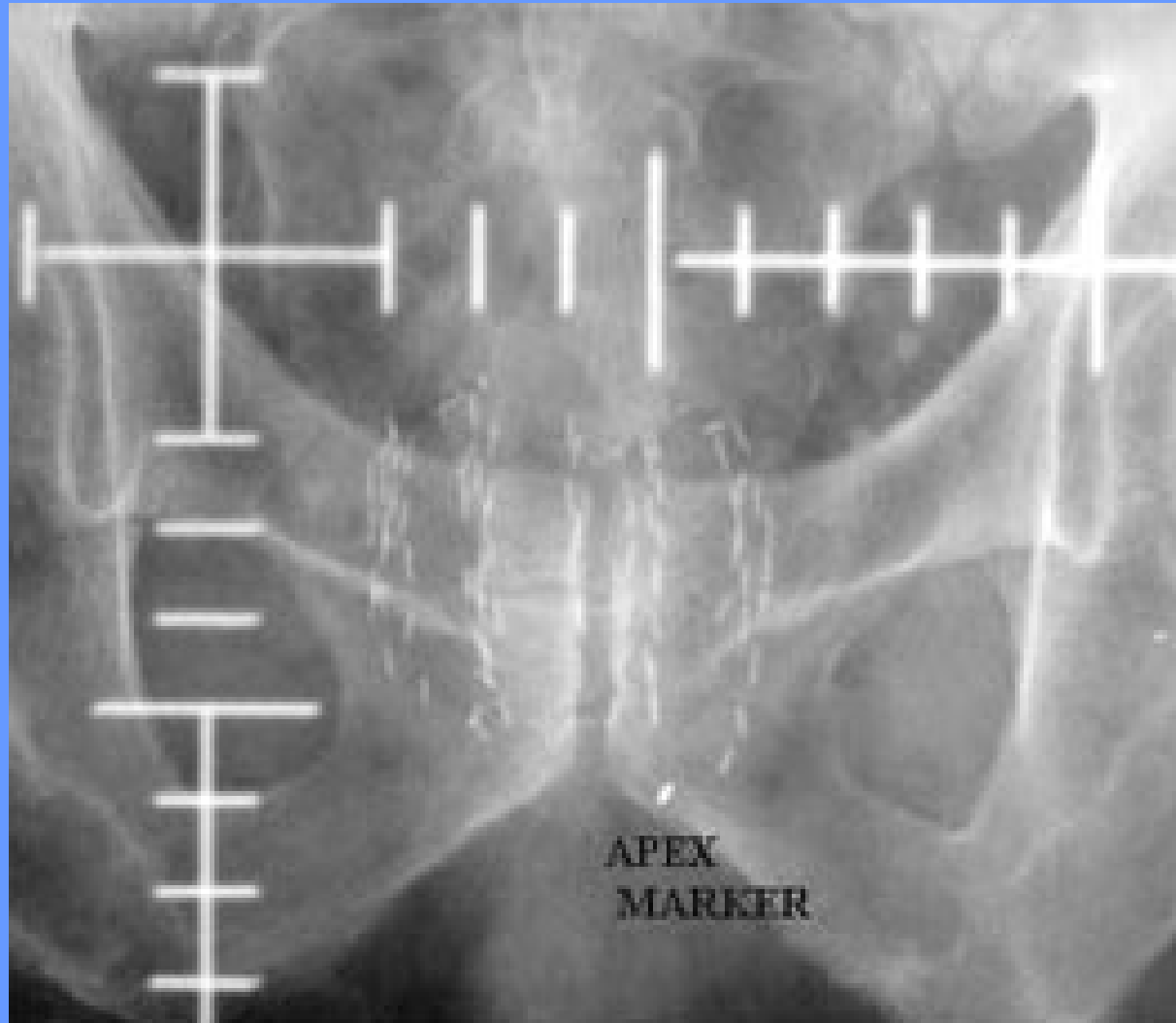
“Seed waking” migration below prostate



PERINEAL PRESSURE



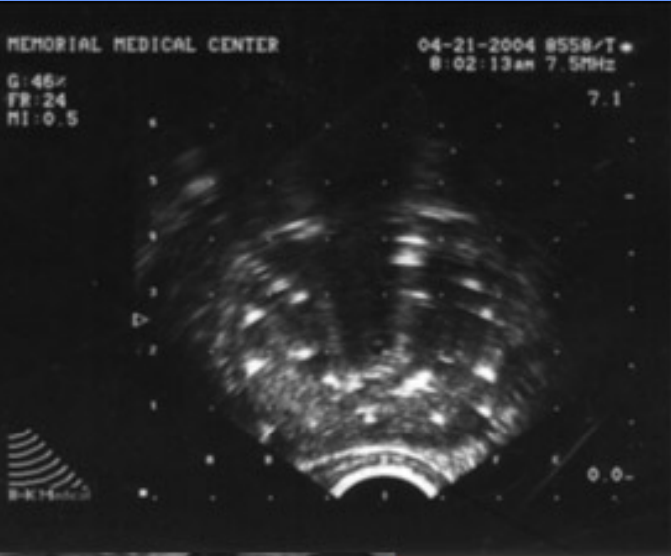
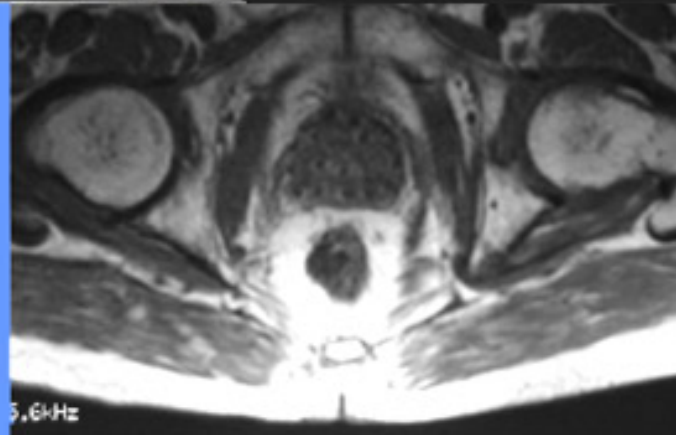
SIMULATION



Correlation of ultrasound and MRI

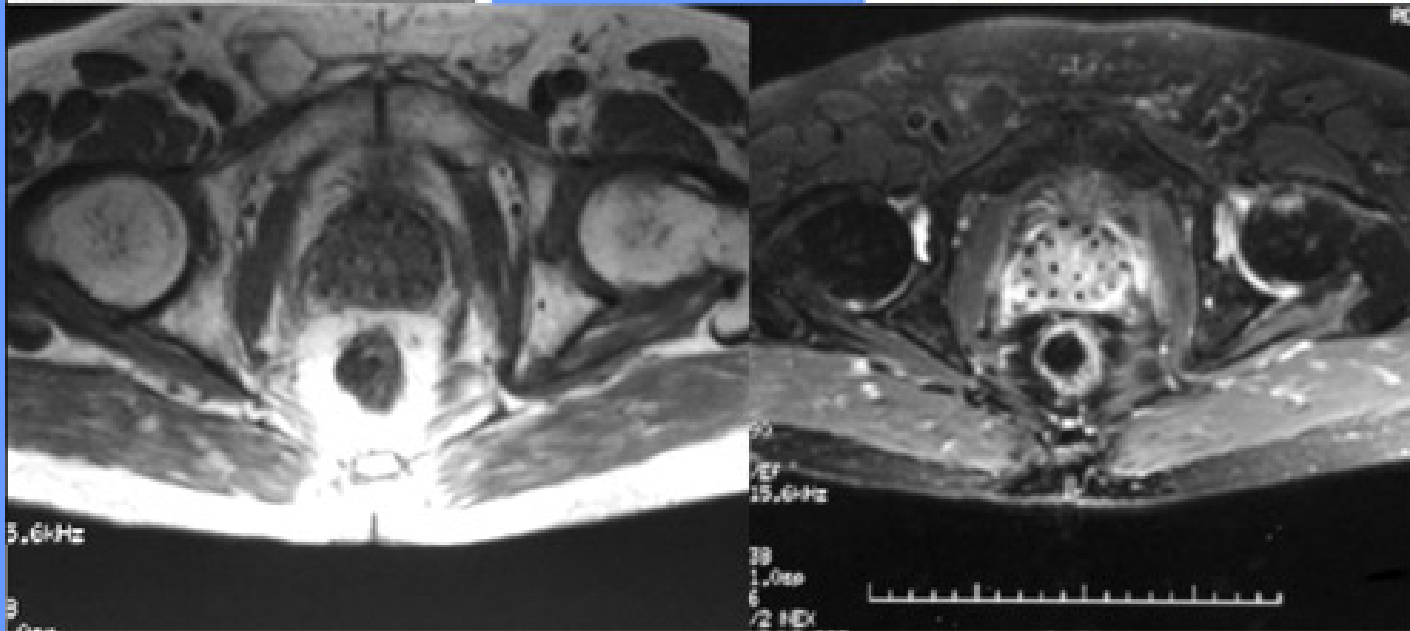
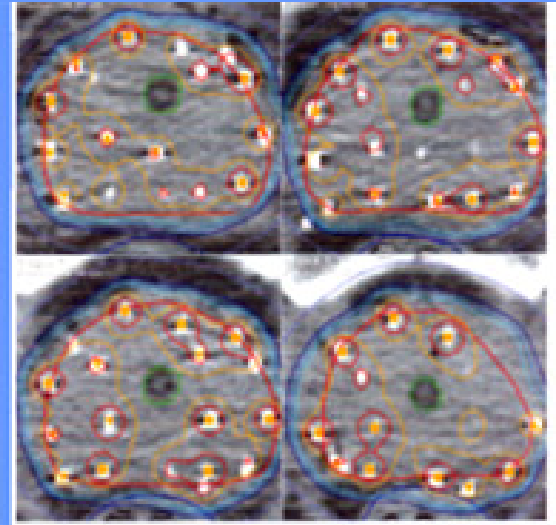
CS:	T1c	PSA:	5.9
GS:	3+3	Tumor Loc:	L+
Template Coordinates used for preplanning			
6	L=5.384		
5.5			
5			
4.5			
4		X	X
3.5		X	X
3		X	X
2.5	X	X	X
2	X	X	X
1.5			
1	X	X	X
	A a B b C c D d E e F f G		

MEMORIAL MEDICAL CENTER
 G: 46
 FR: 24
 NI: 0.5
 04-21-2004 8558/T
 8:02:13am 7.5MHz
 7.1

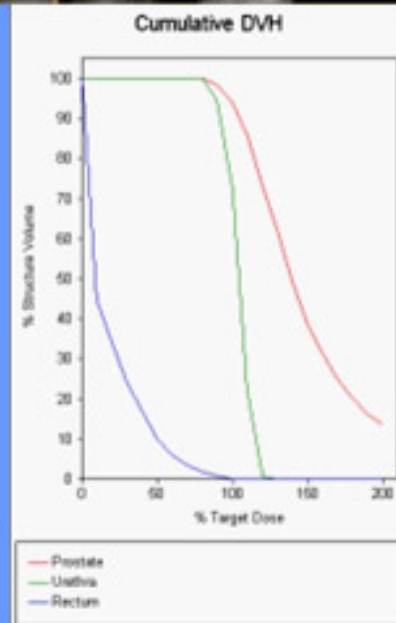
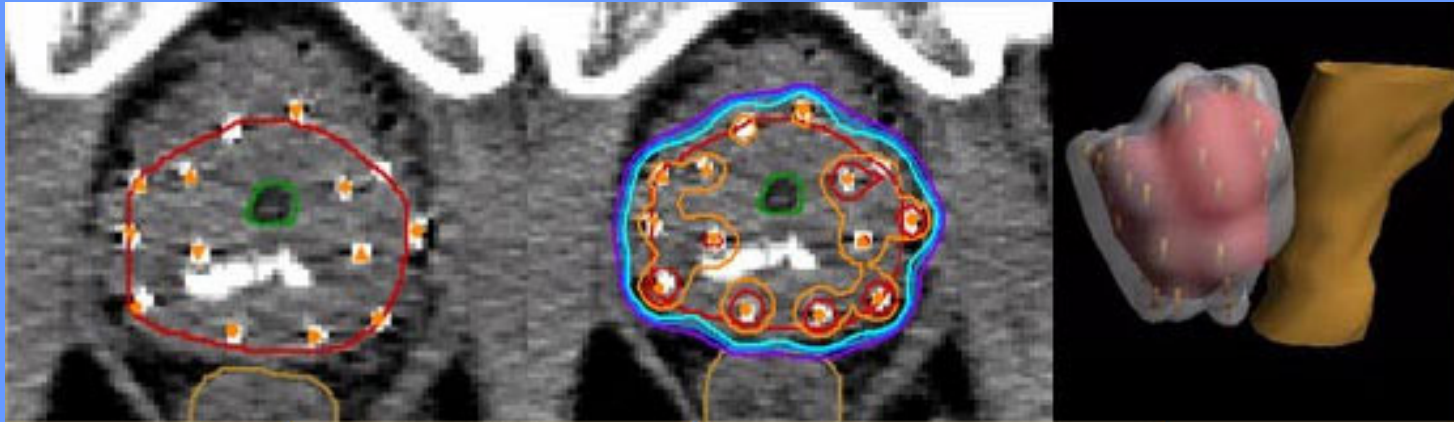



Correlation of CT and MRI

PSA:	T1c	PSA:	5.9
GS:	3+3	Tumor Loc:	Lt
Template Coordinates used for preplanning			
6	L:5.384		
5.5			
5			
4.5			
4		X	X
3.5	X	X	X
3	X	X	X
2.5	X	X	X
2	X	X	X
1.5	X	X	X
1	X	X	X
	A	B	C



DAY 0 POST IMPLANT CT VARISEED 7.1

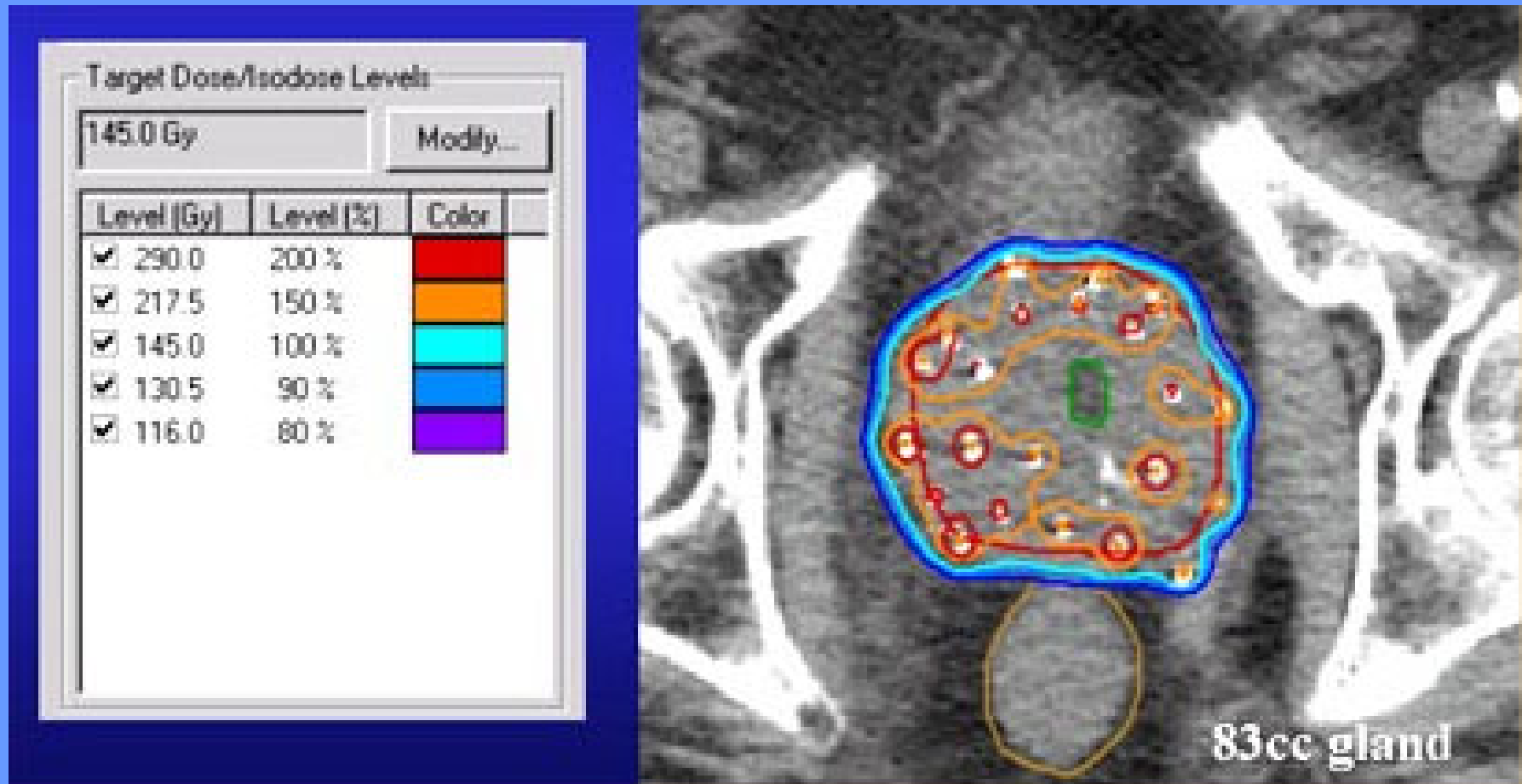


Target Dose/Isodose Levels

145.0 Gy

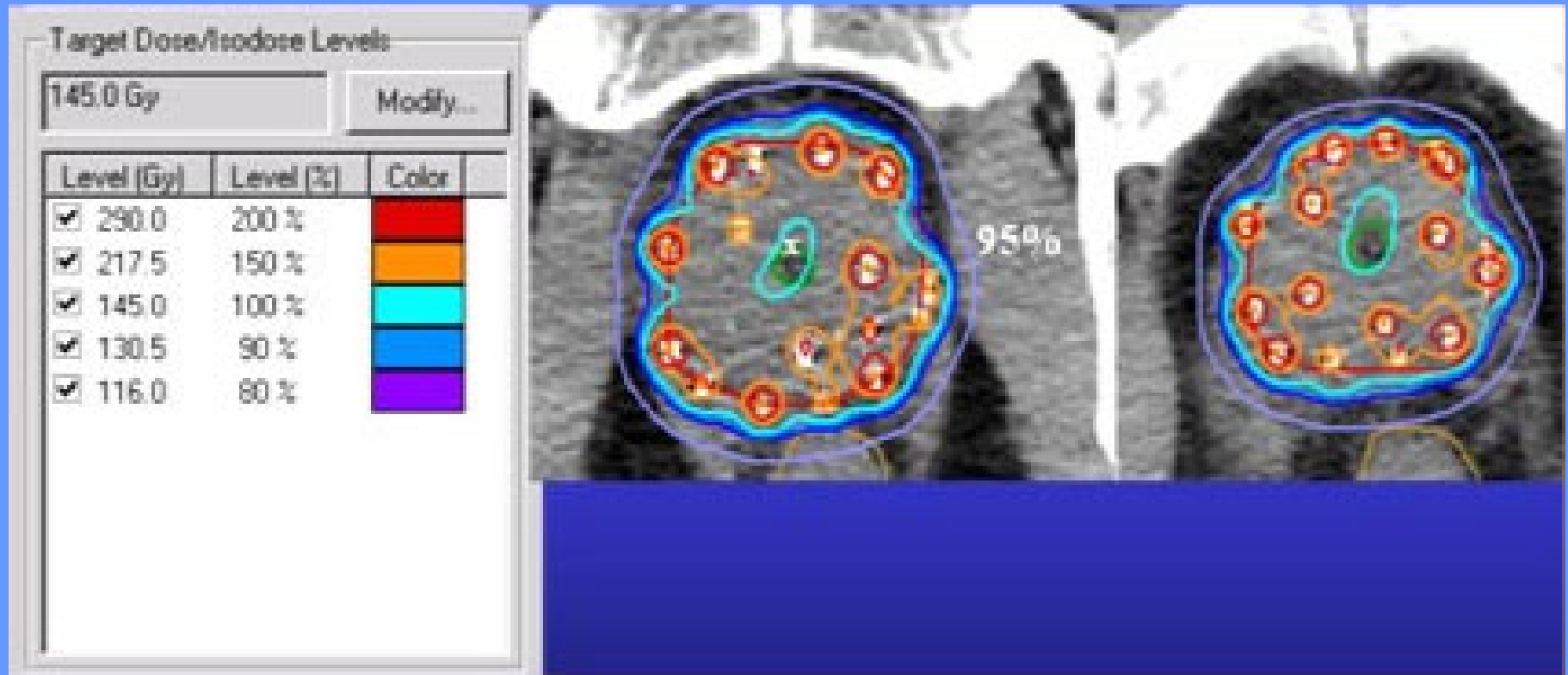
Level [Gy]	Level (%)	Color
<input checked="" type="checkbox"/> 290.0	200 %	Red
<input checked="" type="checkbox"/> 217.5	150 %	Orange
<input checked="" type="checkbox"/> 145.0	100 %	Cyan
<input checked="" type="checkbox"/> 130.5	90 %	Blue
<input checked="" type="checkbox"/> 116.0	80 %	Purple

DAY 0 POST IMPLANT CT

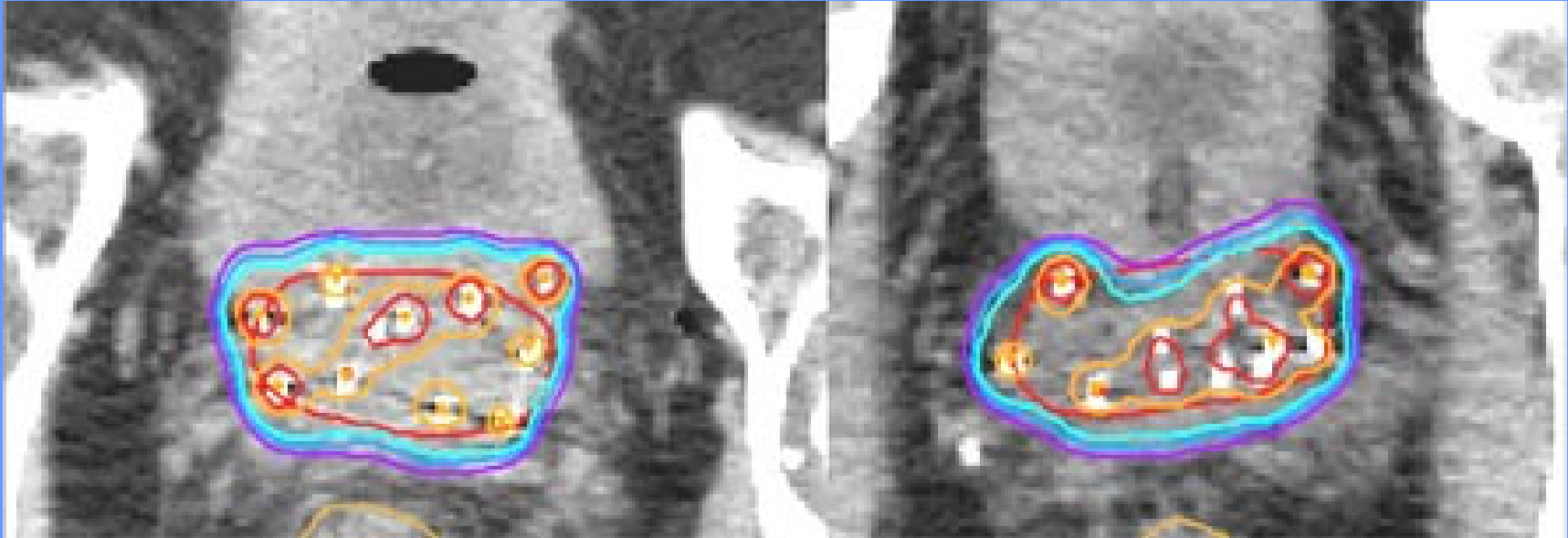


DAY 0 POST IMPLANT CT "B"

Implant



Base Coverage

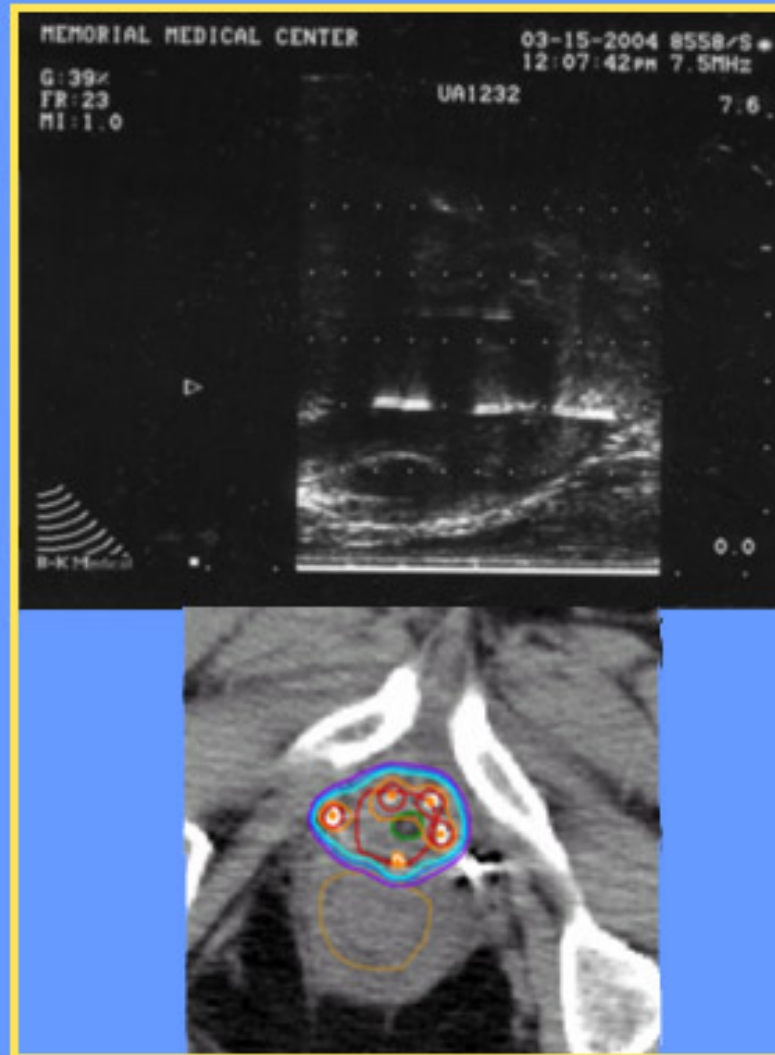


Target Dose/Isodose Levels

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

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

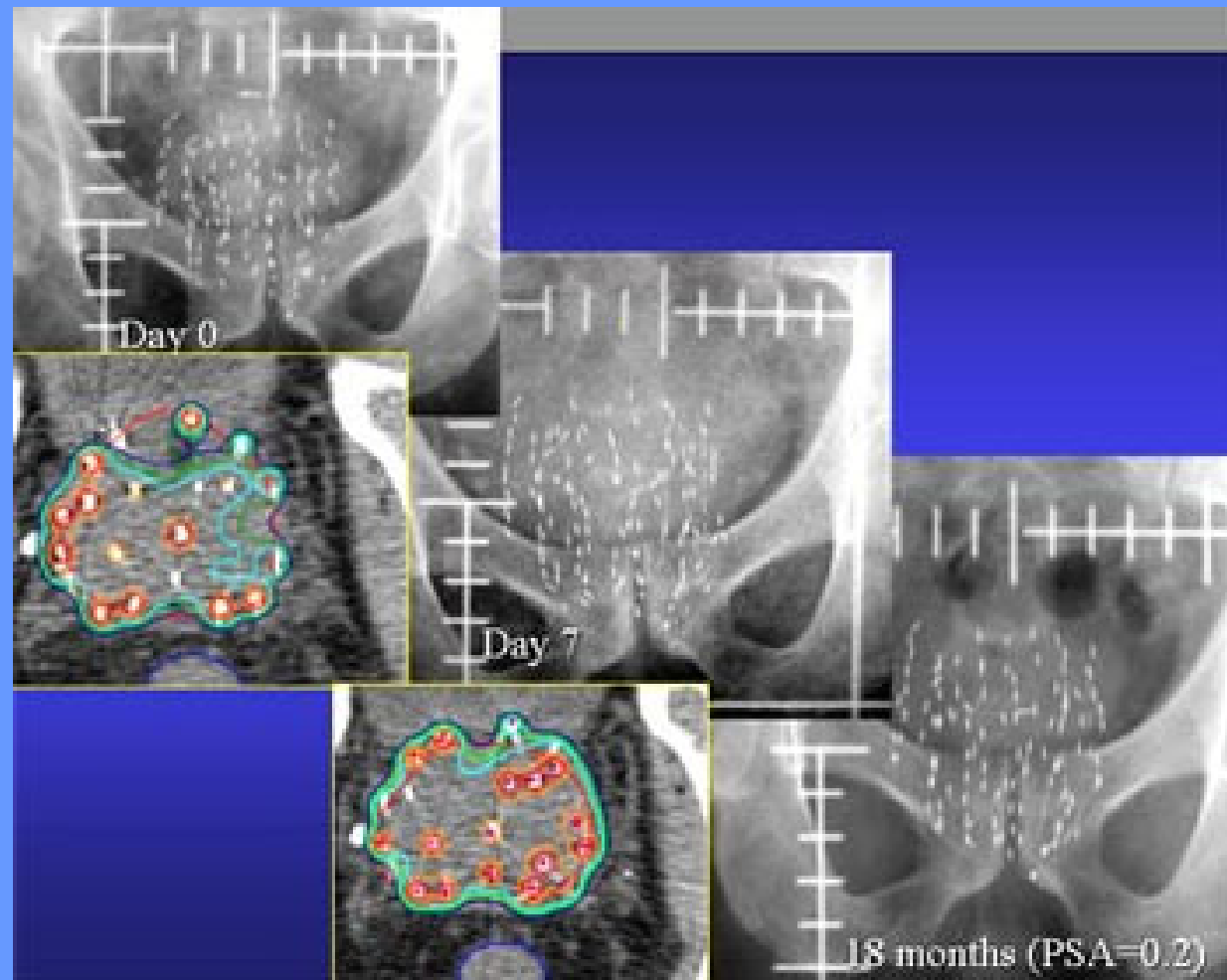
Shanahan et al IJROBP 2002;53(2):490-496

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.**

