



# Interstitial Brachytherapy in Carcinoma cervix

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# HISTORY OF PERINEAL BRACHYTHERAPY

- **1909** : Pasteau & Degrais → Transurethral Radium Capsules : Ca Prostate.
- **1951** : Interstitial injections of colloidal solution of radioactive Au-198 : Prost
- Subsequently I-125 and Pd-103 were also evaluated.
- **1920s**: Interstitial Gynaec.
  - Transvaginal insertion of long low intensity radium needles into the cervical, vaginal and parametrial tumour volume
  - Perineal brachytherapy by Waterman
- Not popular for a long time
- **1978** : Feder, Syed and Neblett rediscovered the technique using plastic templates and LDR Iridium wires
- **1980s** Syed and Neblett propagated use of the template in Anorectal and Prostate cancer
- **1982** : Martinez published the construct and dosimetric characteristics of MUPIT (Martinez Universal Perineal Interstitial Template). Since then many modifications of designs of these have been described



## Perineal Interstitial Brachytherapy

### Gynec.

Cervix

Endometrium

Vagina

Vulva

### G.I.

Ca Anal Canal

### Urological

Prostate

Distal  
Female  
Urethra



# INDICATIONS FOR interstitial BRACHYTHERAPY in Ca Cervix

## 1. Ca Cervix IB, II B & above if

1. distorted anatomy
2. narrow vagina and obliterated fornices
3. Os / Uterine canal not identifiable



Good geometry  
with ICA  
difficult

2. Extensive paravaginal (>0.5cm) or distal vaginal involvement
3. Bulky parametrial disease which will require boost.
4. Persistent or Recurrent Ca Cx post EBRT +/- ICA.
5. Carcinoma of the cervical stump, Cut through hysterectomy.
6. Post operative vault recurrence



# INDICATIONS FOR PERINEAL BRACHYTHERAPY

## Ca Endometrium

**Local recurrence Post Sx +/- RT extending beyond the confines of vaginal vault (not extending to the pelvic wall)**

## Vagina and Vulva

- 1. Radical Brachytherapy in early lesions (T1/N0)**
- 2. Boost in addition to external beam radiotherapy in large lesions (T2/3).**
- 3. Locally confined recurrent cases.**





## INDICATIONS FOR PERINEAL BRACHYTHERAPY

### Urethra

**Interstitial Brachytherapy alone for superficial lesions in distal female urethra.**

### Gastrointestinal

- 1. Boost after external beam radiotherapy in anal canal carcinomas.**
- 2. Recurrent anal canal carcinomas**



## CONTRAINDICATIONS FOR INTERSTITIAL PERINEAL BRACHYTHERAPY

### ***General Contraindications:***

1. Risks for GA/ Epidural anesthesia due to medical reasons.
2. Distant metastases.

**“Careful selection of cases”**

### ***Specific Contraindications:***

1. Residual disease upto lateral pelvic wall.
2. Disease infiltrating rectovaginal septum /posterior bladder wall at the time of brachytherapy.
3. Large volume residual lesions.



### ***Gynecological***

- Syed Neblett Applicator.
- MUPIT.
- Vienna Applicator.
- Hammersmith Hedge Hog.
- Queen Mary Hospital Applicator.

## **APPLICATORS**

### ***Gastrointestinal***

- Syed Neblett Rectal Applicator
- MUPIT

### ***Genitourinary***

- Syed Neblett Prostate Applicator
- MUPIT
- Mick's Applicator for Prostate Seed Brachytherapy.
- Mount Vernon Applicator.

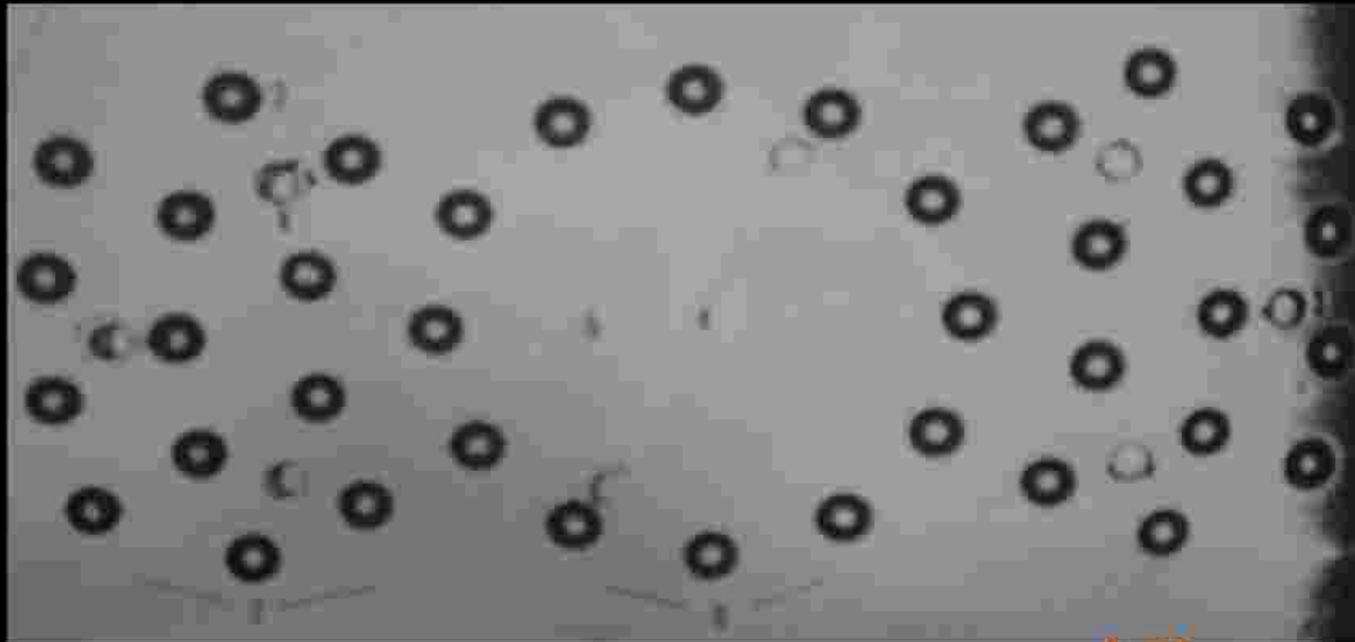




# SYED-NEBLETT TEMPLATE

- Two Plastic / Silicone plates 1.2 cm thick
- 2 cm central hole for vaginal obturator,
- 34 holes with rubber rings ( O-rings) drilled 1 cm apart in incomplete **concentric circles** to accommodate the guide needles.
- Vaginal obturator
  - ✓ 2 cm diameter
  - ✓ Three different lengths of 12, 15 and 18 cm
  - ✓ Central tunnel to accommodate tandem
  - ✓ Six longitudinal grooves on the surface for guide needles
  - ✓ Embedded screw at it's distal end to secure the tandem.
- 17 Gauge hollow needles 20 cm long.
- Long axis held perpendicular to sagittal plane to treat parametria.

Feder, Syed, Neblett IJROBP 1978



Concentric  
arrangement  
s



Ridge for  
obturator

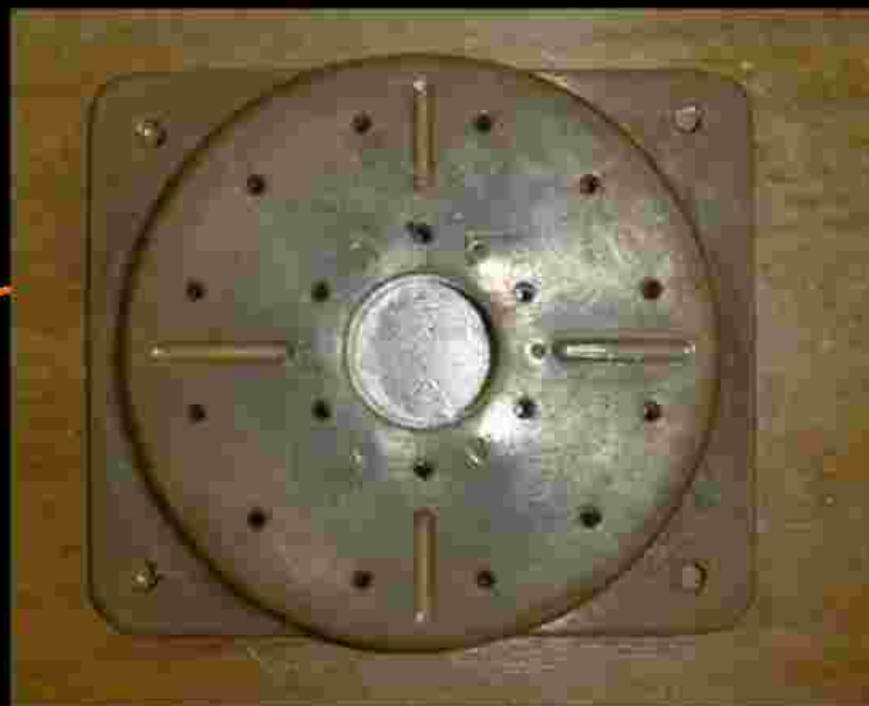


Obturator with grooves

Prostate



Orientation of Central Rings

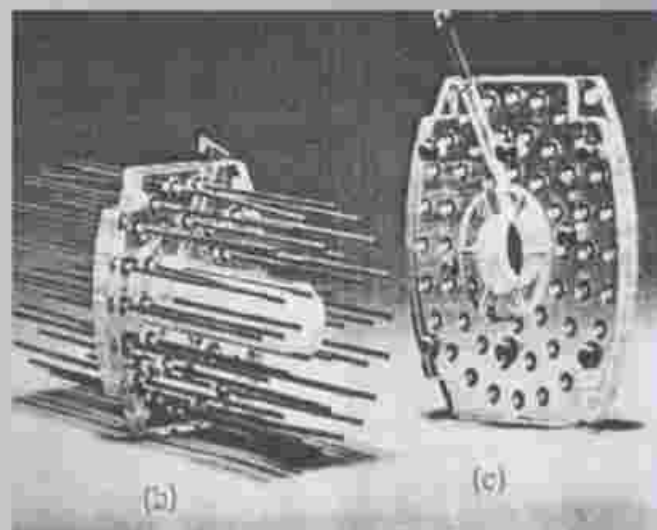
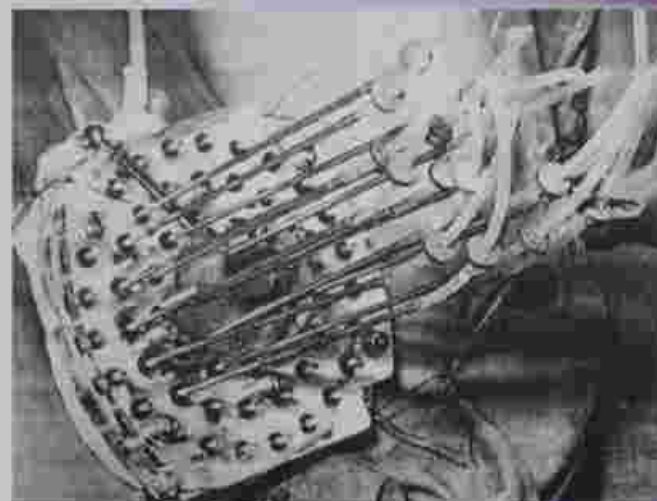




# HAMMERSMITH PERINEAL HEDGEHOG

- **Modified Syed-Neblett template.**
- **Held with long axis parallel to sagittal plane.**
- **Three or four complete concentric rings of holes produced as compared to laterally deficient Syed-Neblett ( for treatment of lower vagina and vulval cases)**
- **Outer tubings with lead washers at needle ends, with decreasing length  $P \rightarrow A$**
- **Allows ease while loading and helps fix Ir. Wires.**
- **Cs source can be inserted through the central needle to substitute for the central ring of needles.**

Br J R 1985, Branson et al

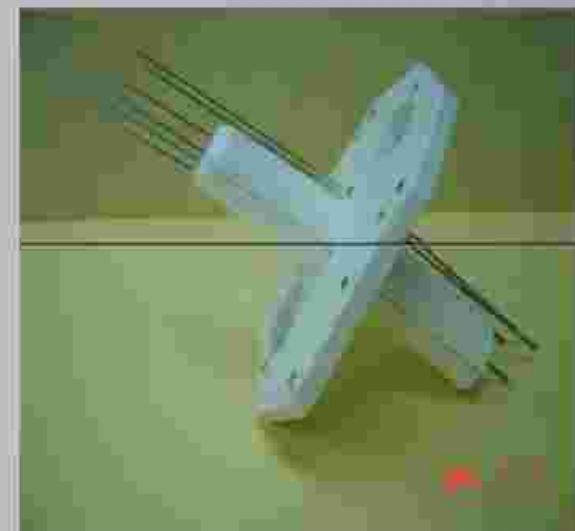
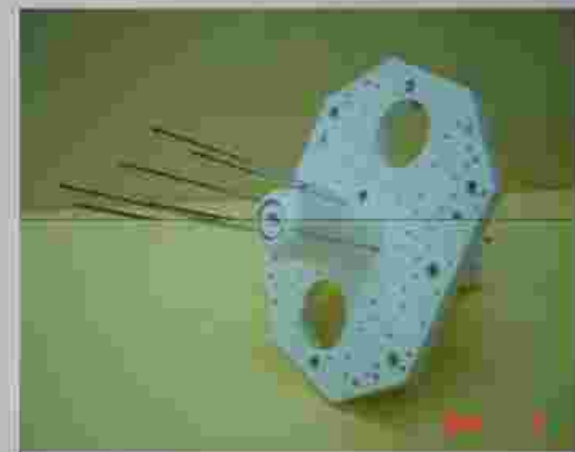






## MUPIT (Martinez Universal Perineal Interstitial Template)

- Multiple site single template
- Used for cervical, vaginal, female urethral, perineal, prostatic and anorectal carcinomas.
- Consists of
  - ✓ Flat acrylic template and flat acrylic cover plate. (11x8x1cm)
  - ✓ Acrylic obturator (two sets), screws and stainless steel needles
  - ✓ Three large holes are located along the vertical centerline. The top slot hole is for the passage of Foley catheter from the urethra and central and bottom holes for the vaginal and rectal cylinders.
  - ✓ Array of holes that for the most part determine the geometry of source placement with respect to anatomic structures.



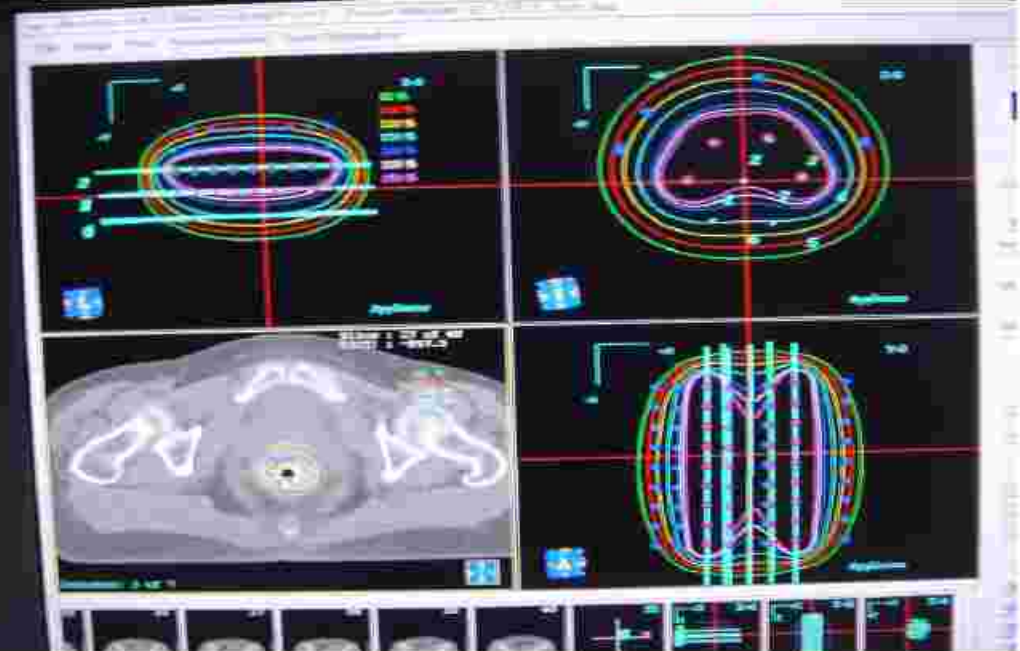
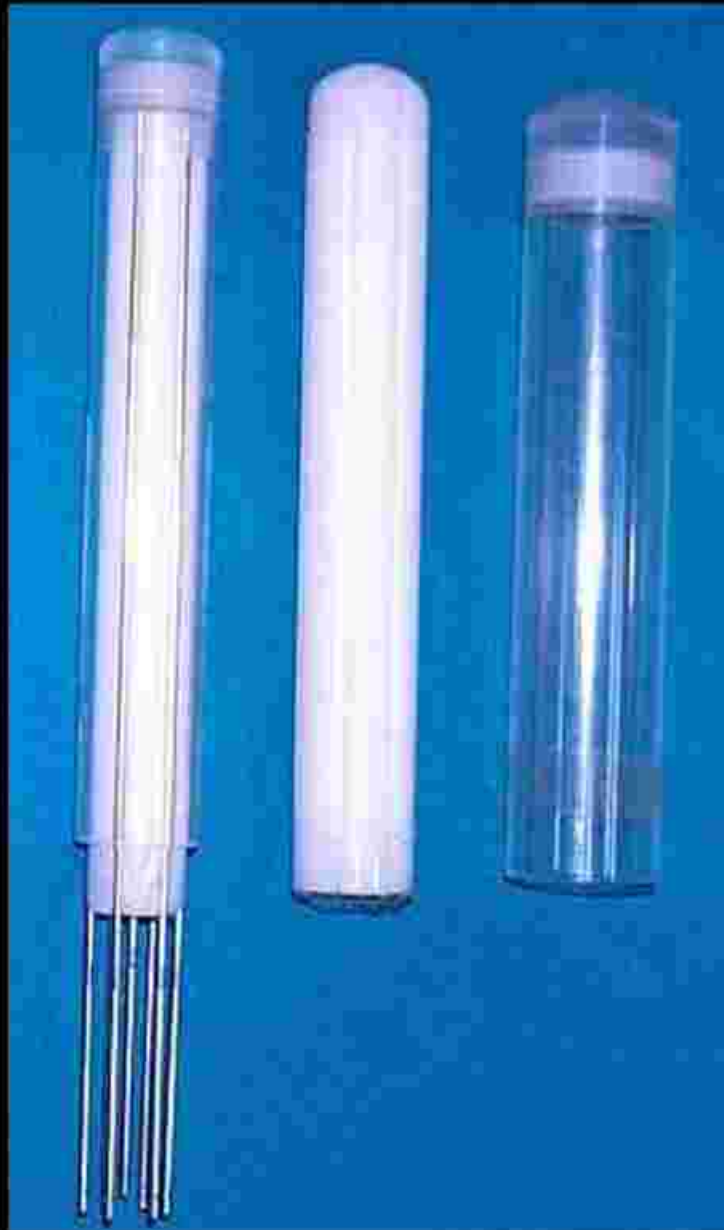




- **Type I holes**
  - Perpendicular to the template,
  - Only volumes extending 4 cm to either side can be covered
- **Type II holes**
  - Oblique to the template, angled approximately 13 degree laterally outward.
  - Divergent rows allows coverage of larger volume of parametrium without hitting the ischium.
  - Type II holes volumes extending outward to 7 cm can be covered upto a depth of 14 cm.
- **Central hole** in vaginal cylinder
  - space for uterine tandem or
  - hole for drainage of secretions.
- Each **cylinder** → 8 guide holes for placement of trocars near the vaginal or rectal wall.



# PERINEAL TEMPLATE-TMH





# Perineal Interstitial HDR Brachytherapy

## Martinez Universal Perineal Interstitial Template MUPIT

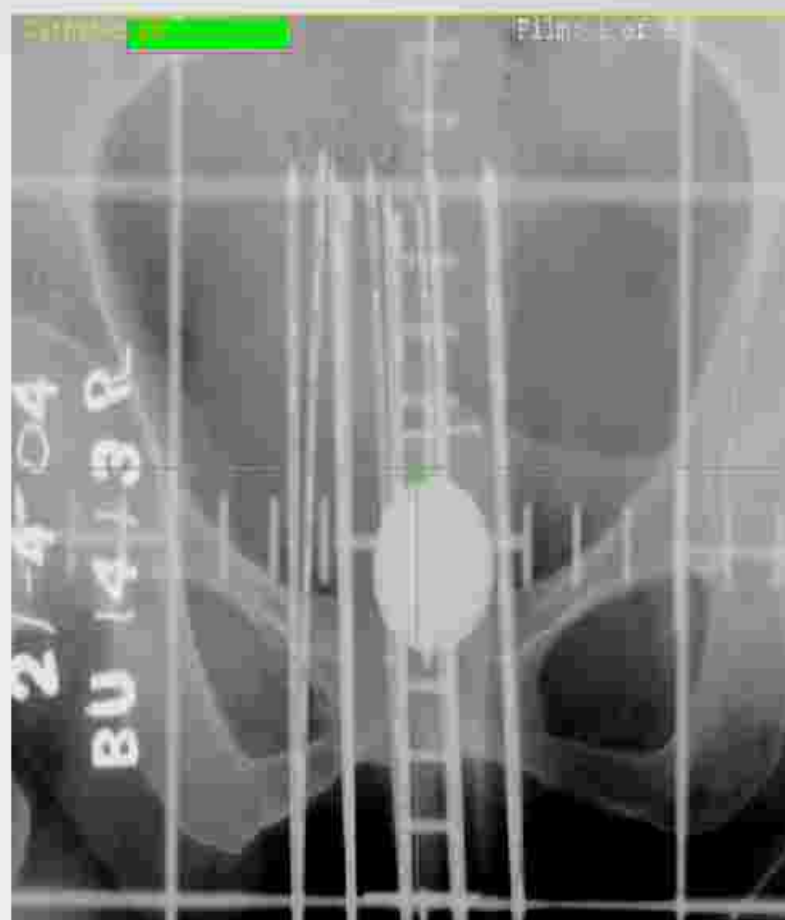
- 25 Needles, Multiple plane implant
- CT Scan images with 3-5 mm slice thickness
- Image acquisition and Delineation
- Catheter reconstruction and
- Source loading (6-6.5 cm)
- Basal dose points (Paris Dosimetry system)
- Dose prescription
- Geometrical Optimization based on volume
- Graphical Optimization
- Plan evaluation (DVH)



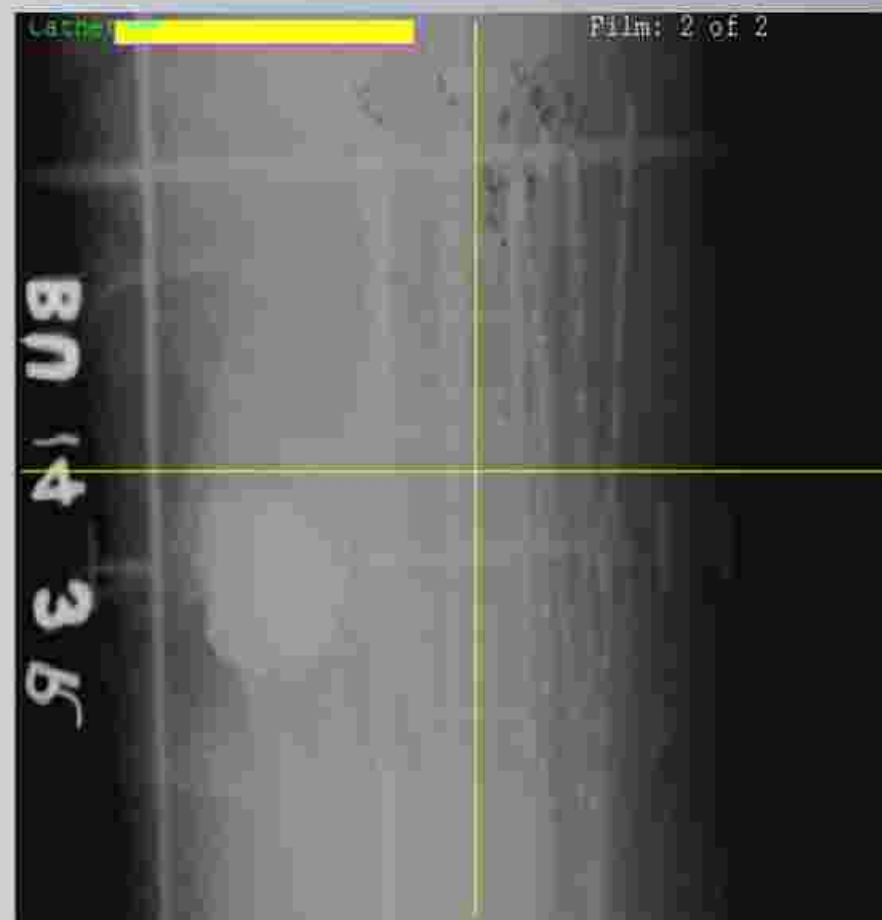


# Image Acquisition for MUPIT Template

Ant Radiograph

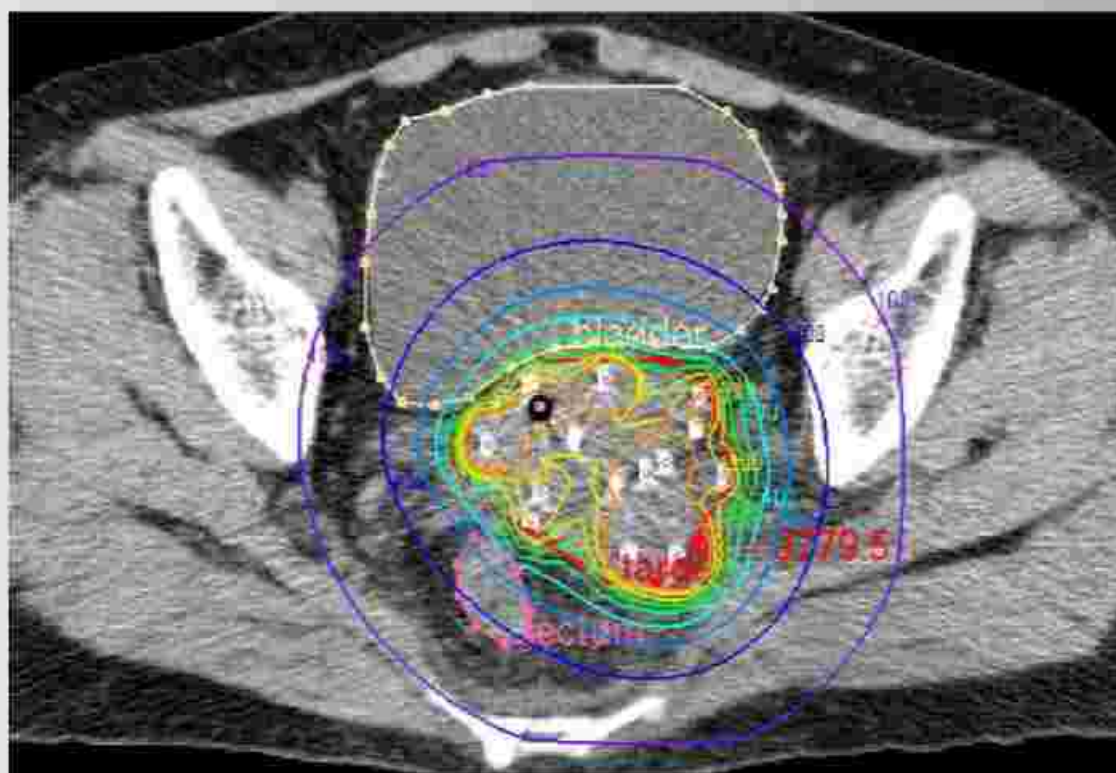


Lat Radiograph



Implant Orientation and Needle identification is very important





Good implant procedure = good dose distribution  
—Image-guided approach is important—



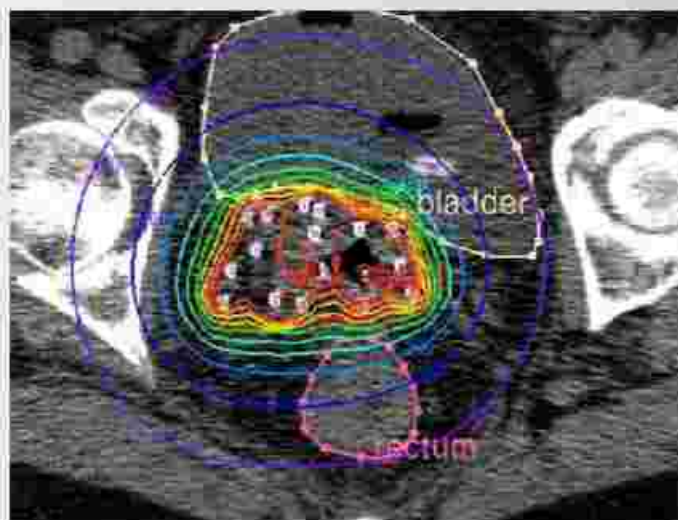
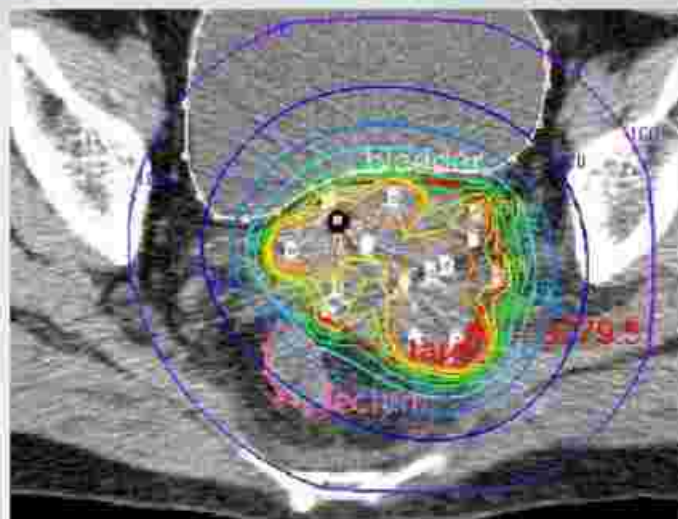


# Recent advances of brachytherapy

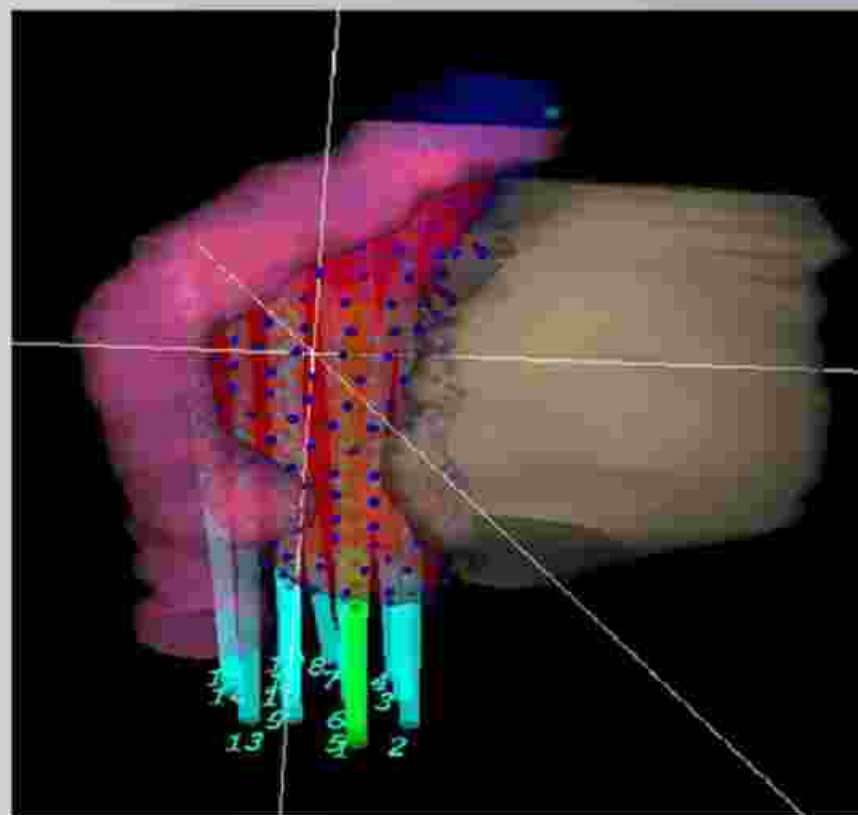
- 1: image-guided
- 2: Image-based
- 3: high dose-rate (optimization)
- 4: interstitial approach



# Image (C T)-based brachytherapy planning

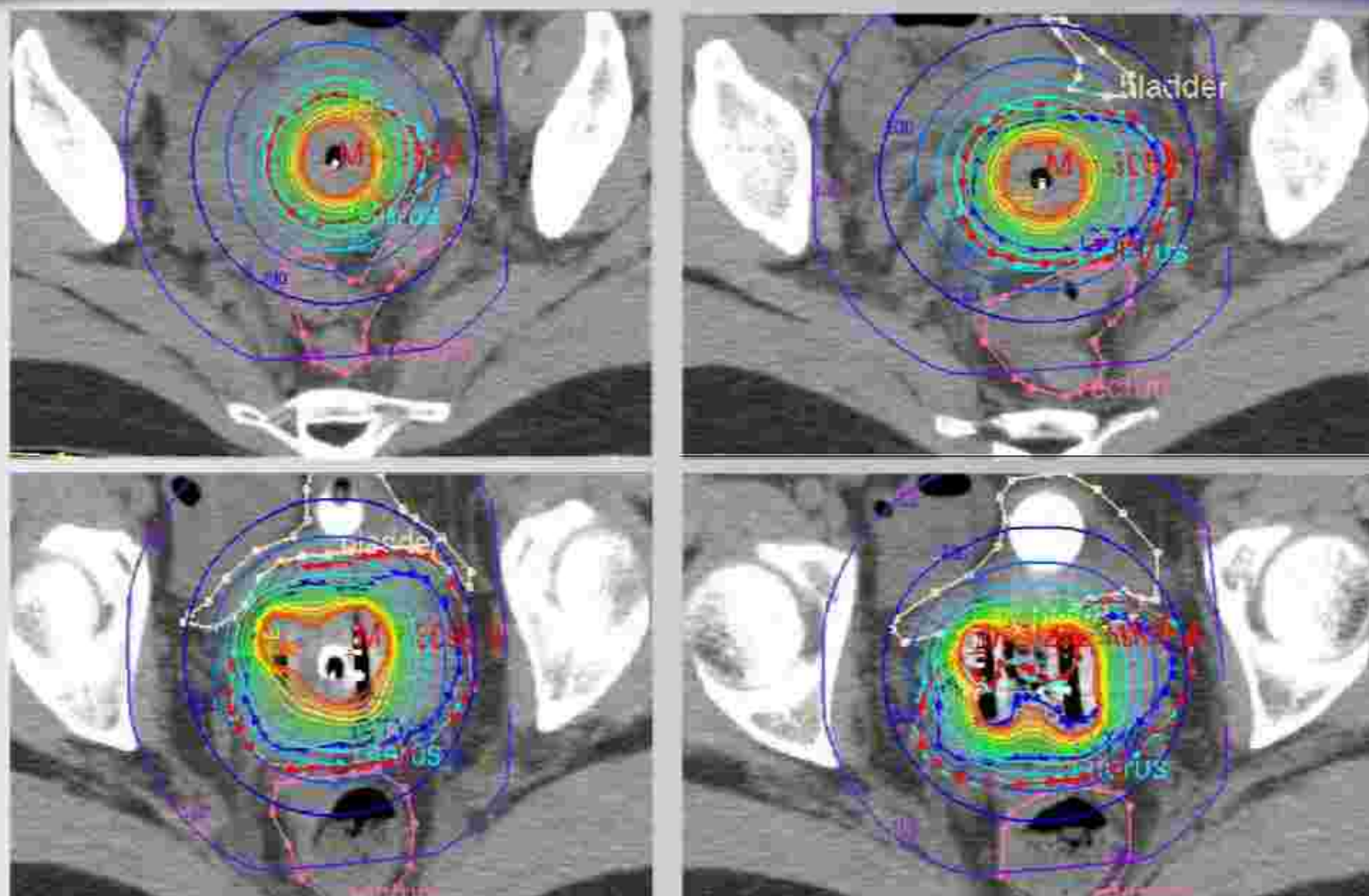


- visible target and OAR
- easy reconstruction of the needles
- optimization program





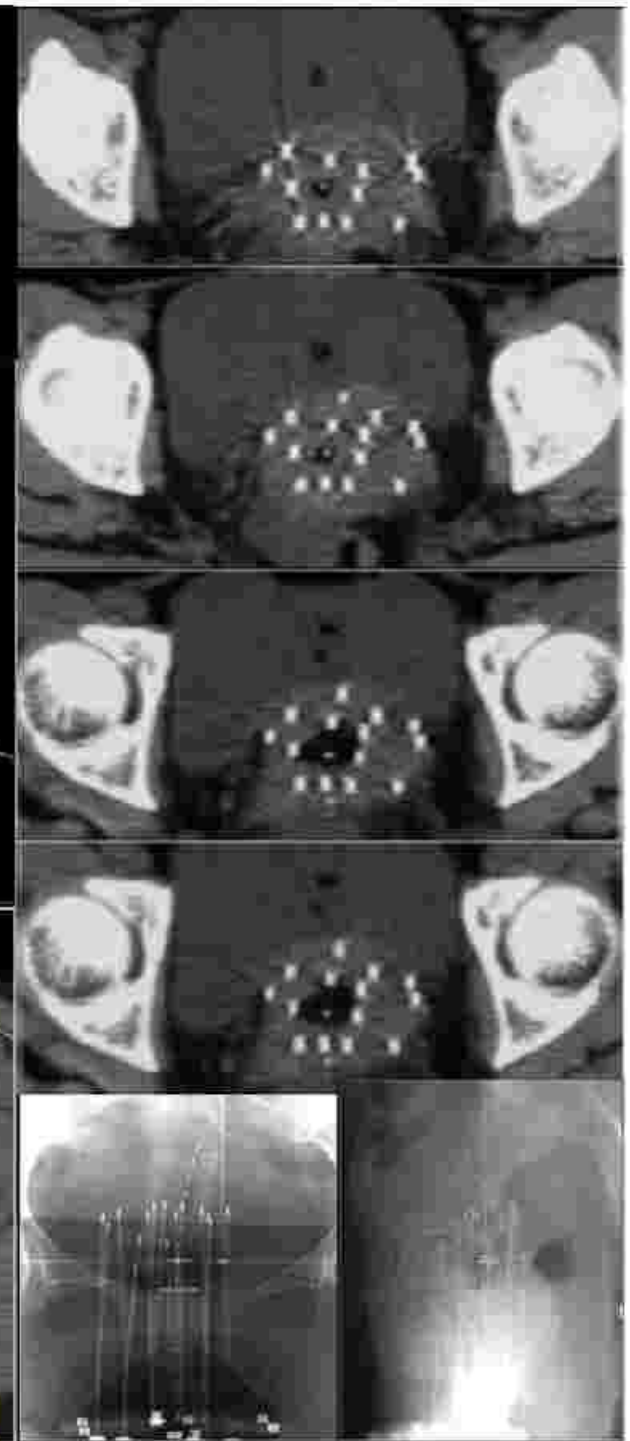
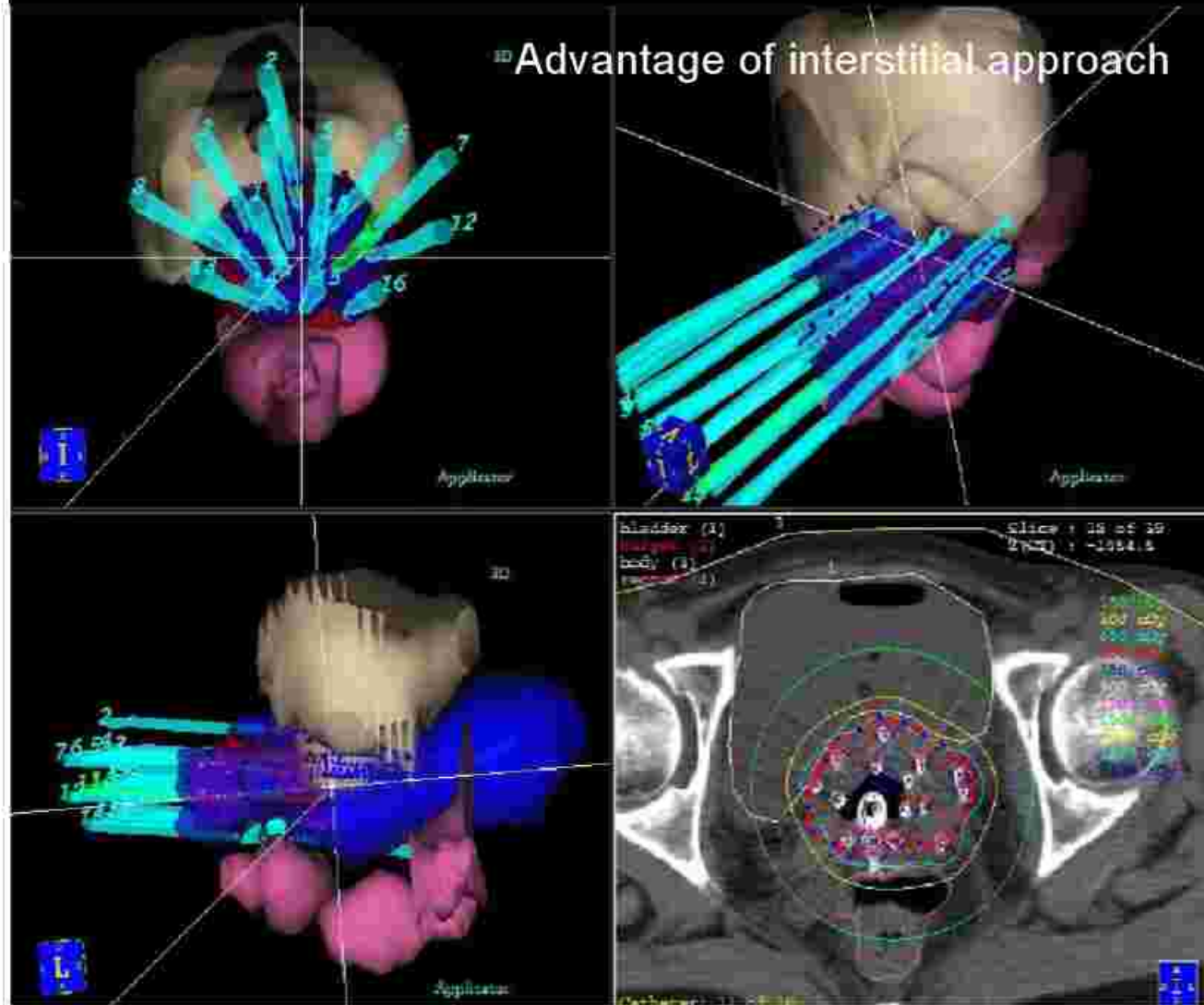
# Advantage of interstitial approach

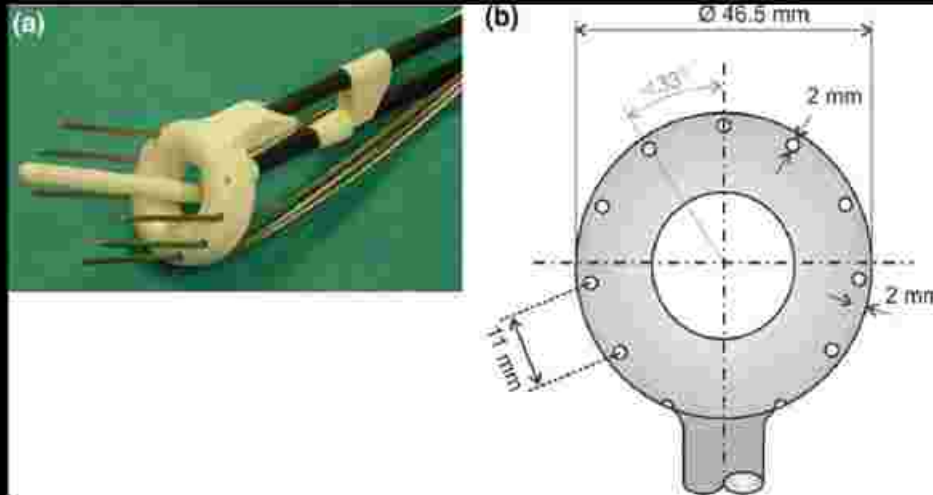


**Not enough coverage of the tumor by typical ICB**

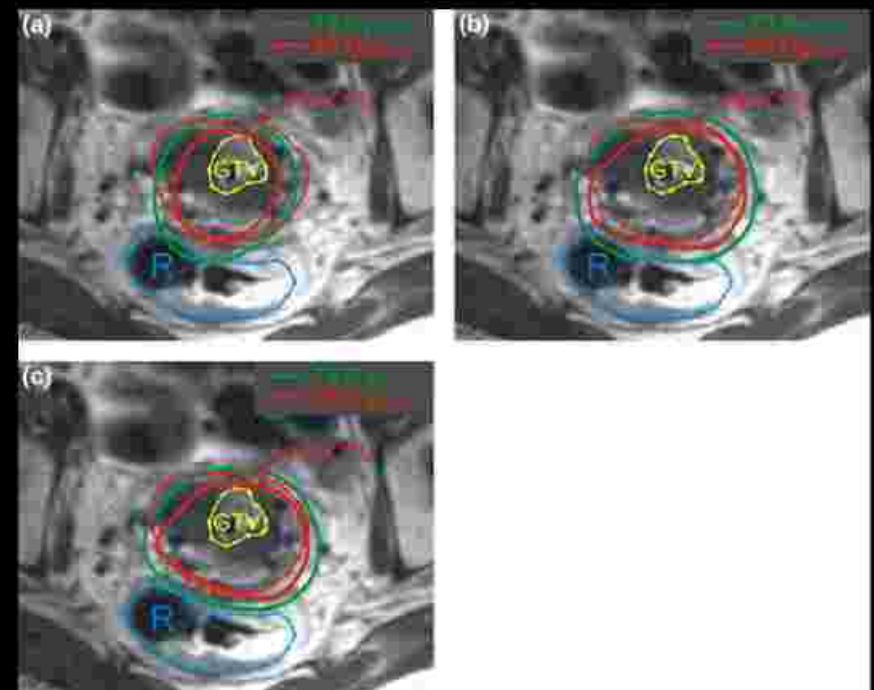
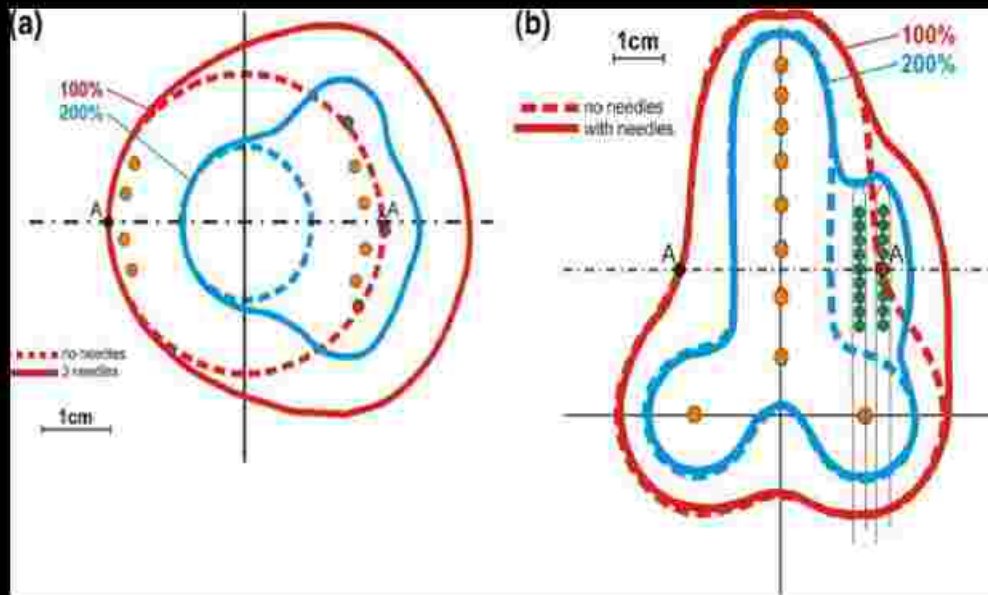


# Advantage of interstitial approach ICB + Interstitial brachytherapy





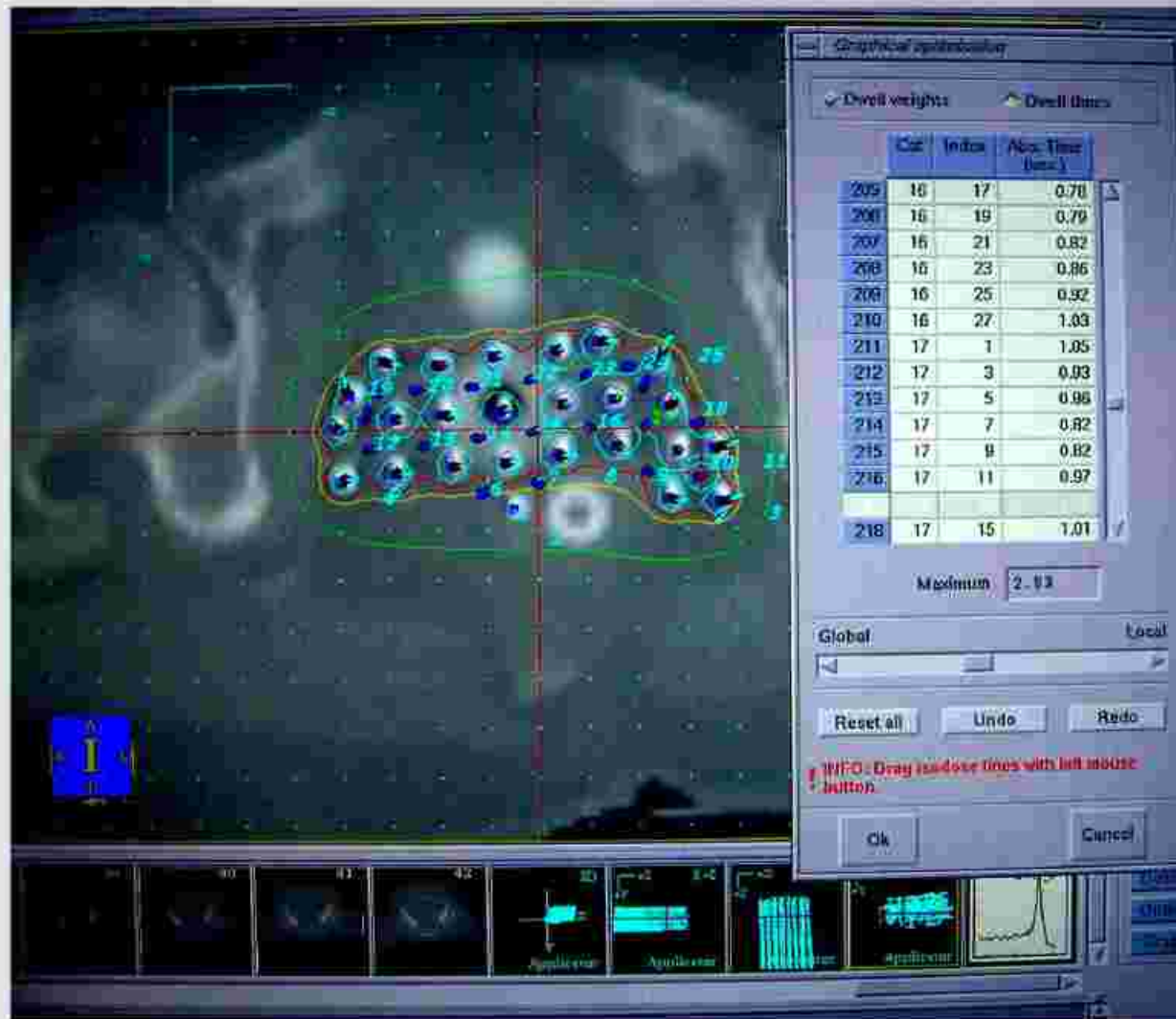
(a) The standard loading of the tandem and ring with prescription to point A shows insufficient coverage of the HR CTV (D90: 5.7 Gy, V100: 75%). (b) Loading of three needles available on the right and two needles on the left improves target coverage to 92%. By using this plan, the D2cc for the rectum would be  $>4.9$  Gy, thus exceeding the total dose constraint of 75 Gy $\alpha\beta 3$ . (c) In the final plan, the dwell weights are adjusted to achieve 91% HR CTV coverage (D90: 7.1 Gy prescribed dose) and 4.4 Gy for the D2cc to the rectum. One additional implanted needle on the right ventral side of the HR CTV further increased the dose to the target during the following three fractions.





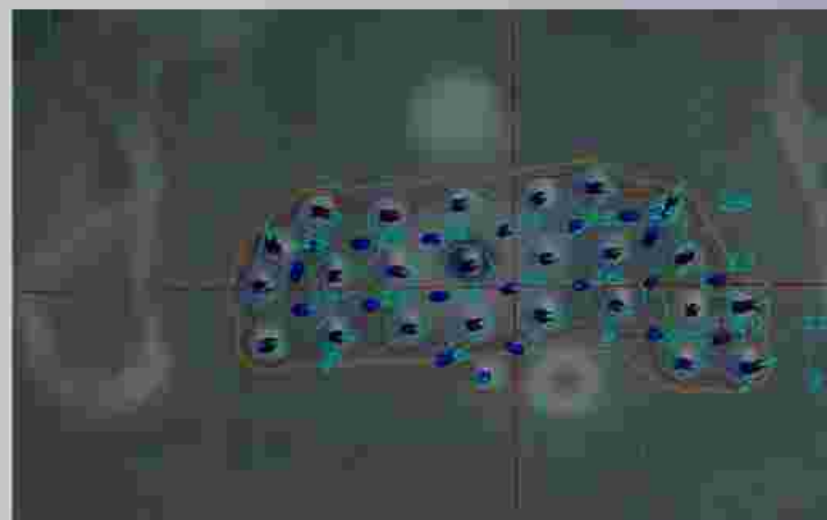
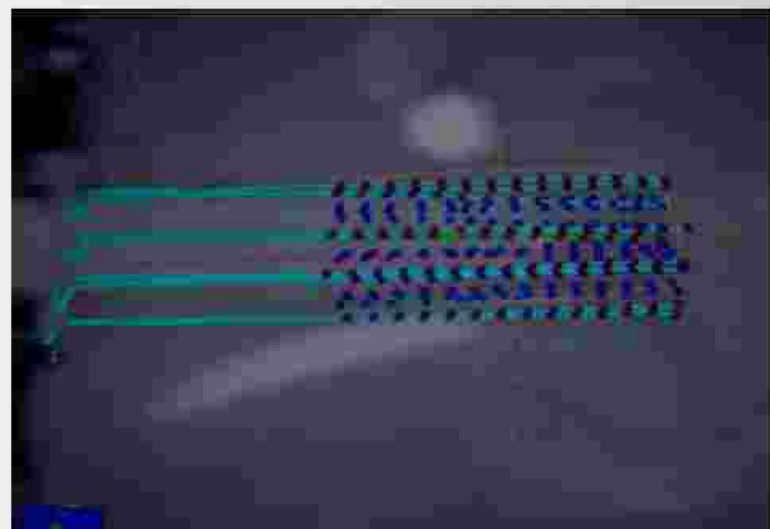
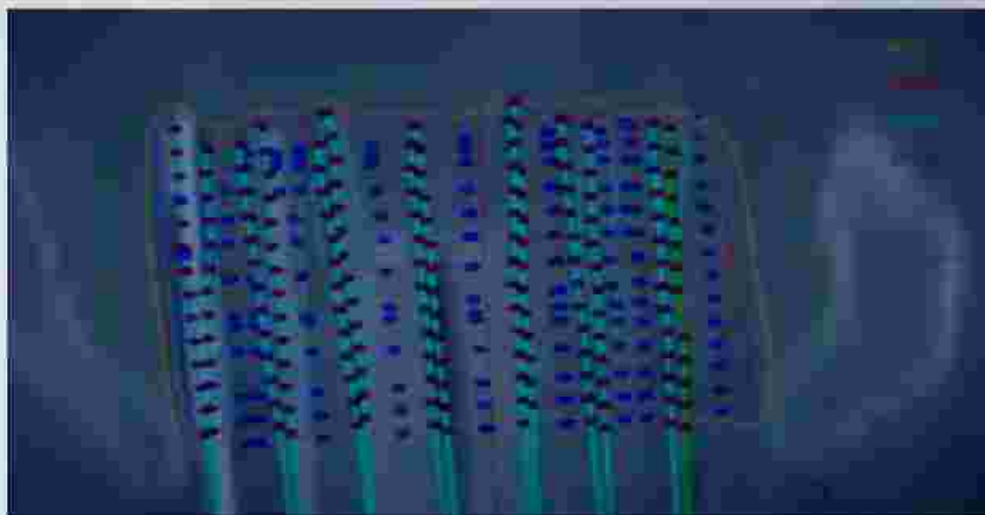


# Graphical Optimization Technique

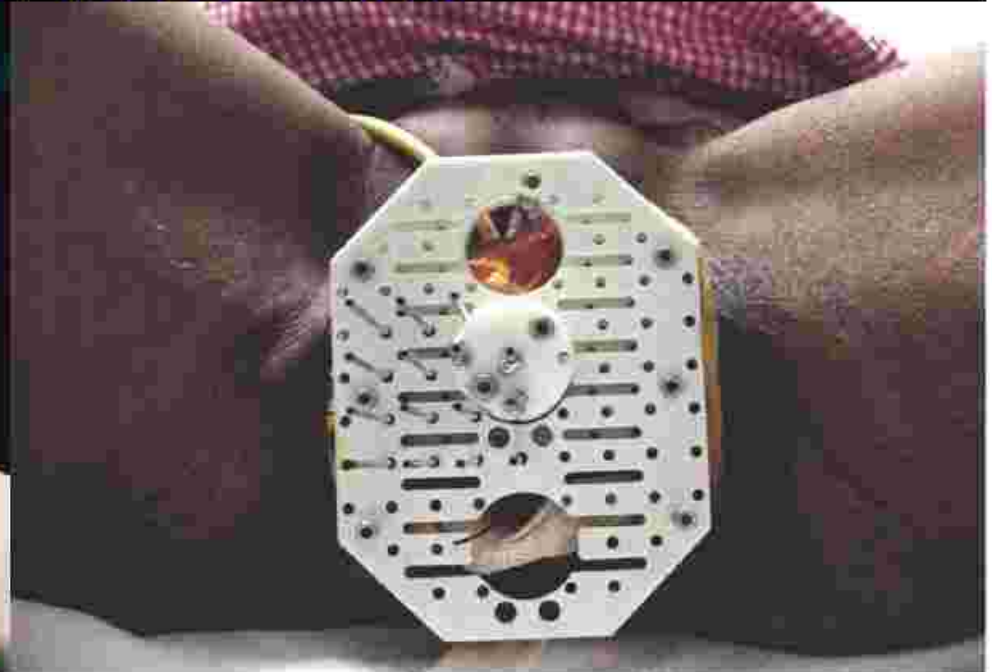
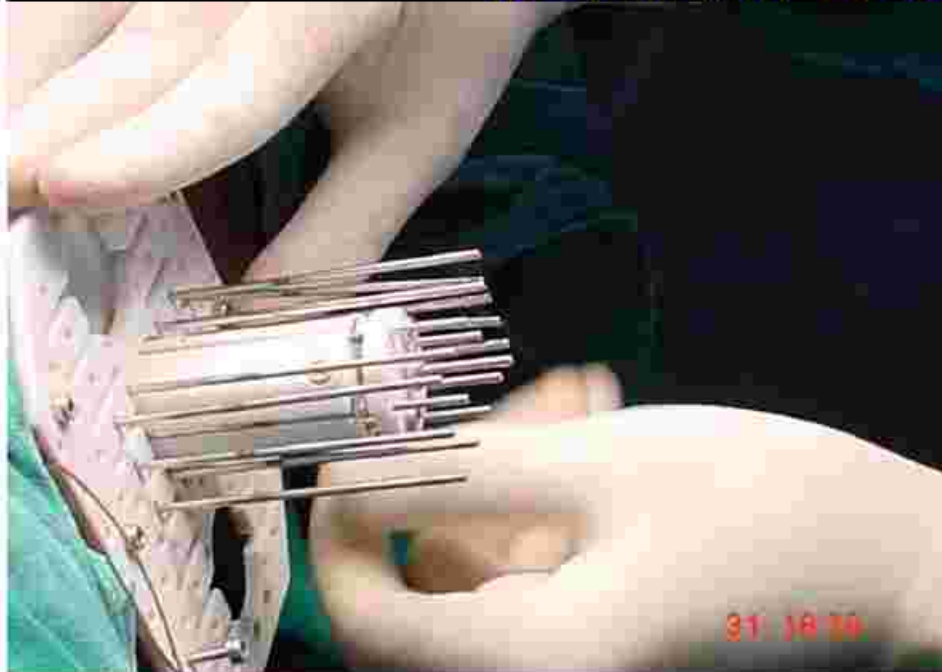




## Three Dimensional Dose Distribution with MUPIT

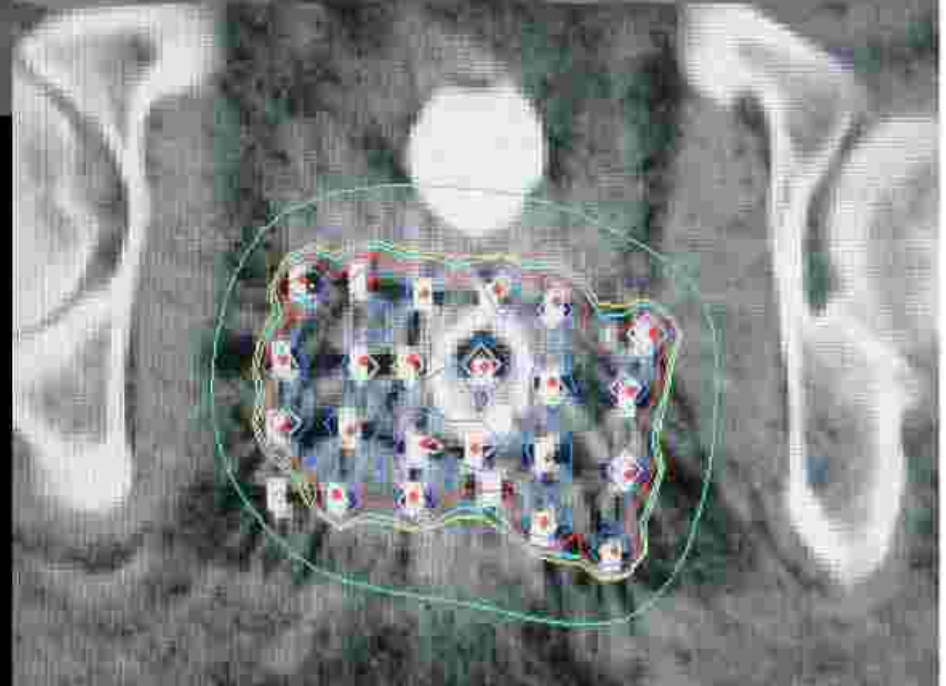
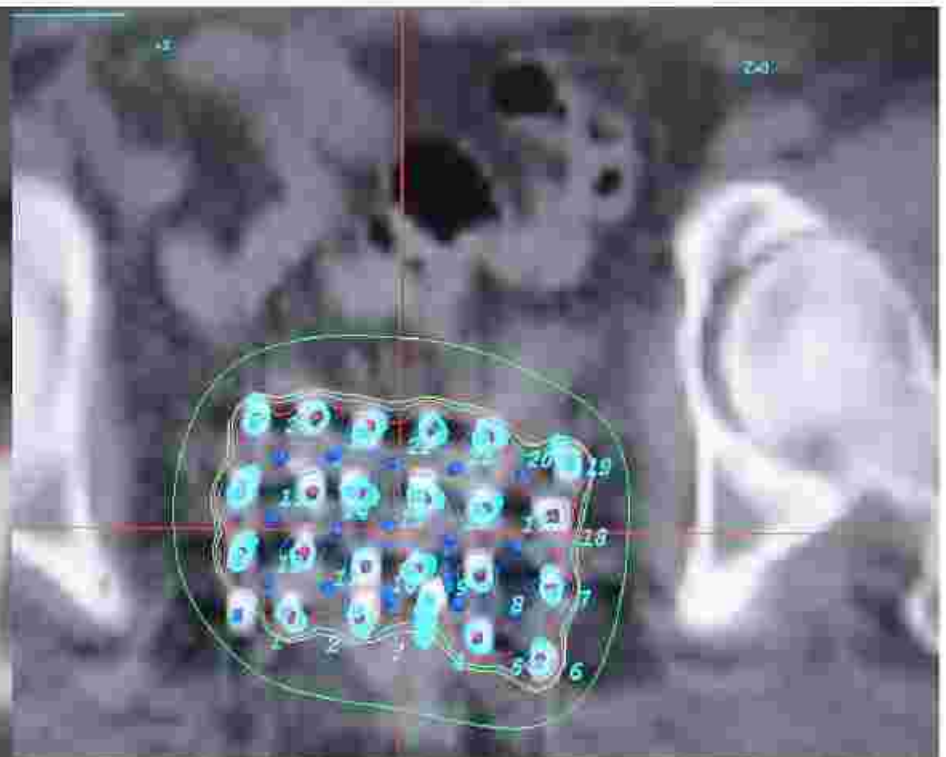
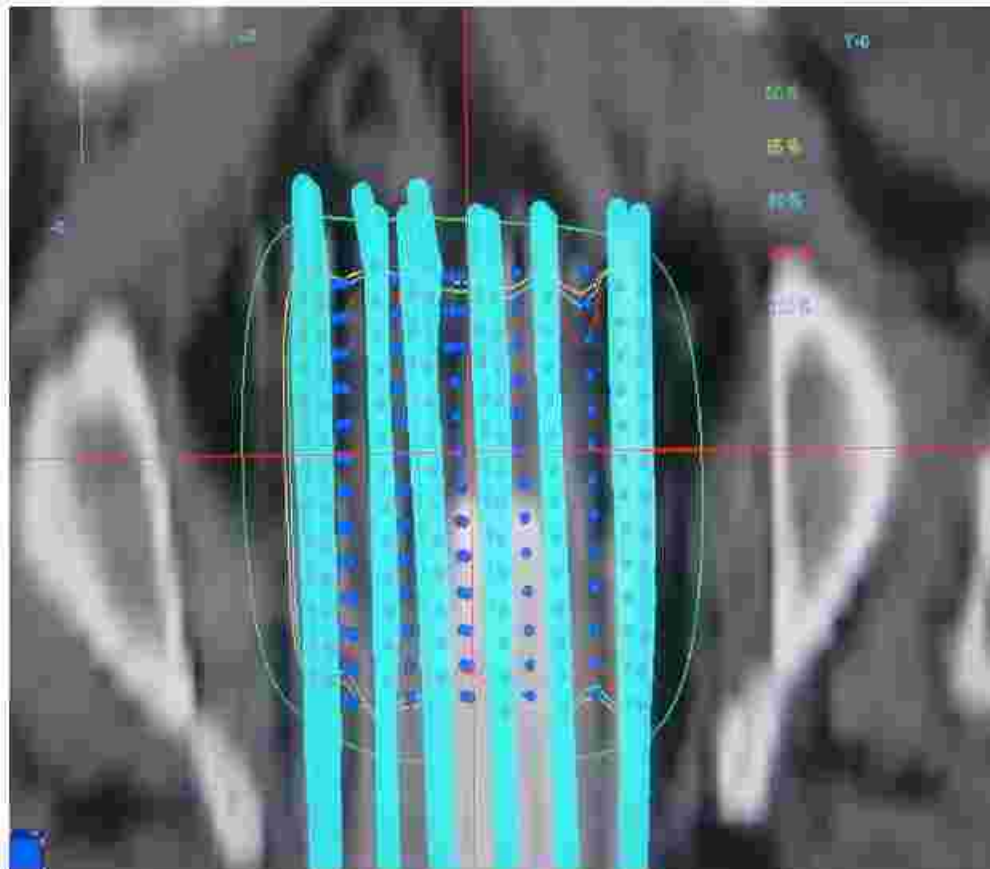


## MUPIT IMPLANT IN CA CERVIX





# PERINEAL INTERSTITIAL BRACHYTHERAPY





## Comparison of series using interstitial implants

Study	NO: of patients	Type of implant	EBRT dose	Brachy dose	Median FU	Local tumor control	Gr 3-4 late toxicity
Demanes	62	Syed Neblett	36Gy + 14GyMLB	6Gyx6# HDR	40 mths	94%	6.5%
Gupta	69	MUPIT	39GY	32Gy	30 mths	60%	14%
Nag S	39	Syed Neblett	50Gy	30Gy	36 mths	48%	2.5%
Martinez	63	MUPIT	-	-	36 mths	83%	3%
Hughes-Davies	139	MUPIT	42Gy	30Gy	57 mths	25%	17%
Monk BJ	70	Syed Neblett	50 Gy	41Gy	58 mths	32%	21%





# Interstitial Brachytherapy Retrospective analysis

N= 39

- **Post Hysterectomy Ca.Cx / Vault Recc : 21 (54%)**
- **Ca.Vagina : 18 (46 %)**
- **Treatment Protocol : RT +/-CT (weekly cisplatin)**
  - **XRT : 45-50 Gy / 25 # / 5-6 wks.**
  - **MUPIT : 3.5-4 Gy / # @ 2 # / day total 4-6 #**
- **Toxicities**
  - **Procedure related : Nil**
  - **RT related : Gr II : small bowel (2 pts) ; rectal (1 pt)**



## Treatment Outcome N = 39

- Median Follow-up : 16 months (10 -104 months)

- Loco-Regionally Controlled : 24 (62%)
- Persistent Disease : 1 (2.5%)
- Central Recurrence : 10 (25%)
- Loco-Regional Recurrence : 3 (7%)
- Distant Metastasis : 1 (2.5 %)

### Disease free Survival

