Non interstitial techniques of Accelerated Partial Breast Irradiation

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Established APBI Techniques

- Multi-Catheter Interstitial Brachytherapy
- Mammosite Balloon Brachytherapy
- 3D-Conformal External Beam Radiotherapy
- Intraoperative Radiotherapy

Hybrid Brachytherapy Devices

- Alternative Brachytherapy Sources
- Permanent Seed Implantation

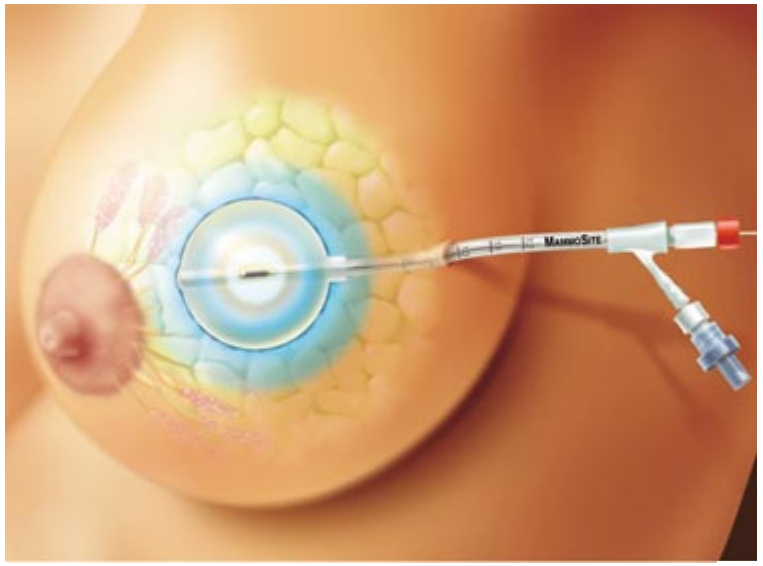
Novel External Beam Approaches

- Helical Tomotherapy
- CyberKnife
- Proton Beam Therapy

Challenges for interstitial brachytherapy in recent years

- Technically demanding procedure
- Physics support
- Definite learning curve

Non Interstitial APBI Irradiation devices



Mammosite device

- Double-lumen catheter , inflatable balloon at tip
- Balloon placed in the lumpectomy cavity
- Placement either at 1) Primary surgery or
  2) Guided by ultrasound up to 10 weeks post-operatively)
- Subsequently filled by saline and contrast material
- Aim to stretch the surrounding tissue tightly around it

Mammosite device

- A high-dose rate source inserted through the inner lumen into the centre of the balloon
- Radiation delivered to the shell of tissue immediately surrounding the lumpectomy cavity.
- Most widely used regimen 34 Gy/ 10 #, 2# per day
- Dose prescribed 1 cm from the surface of the balloon.

Mammosite Results

- 1449 cases with early-stage breast cancer (BCT)
- Treated with the MammoSite device APBI
- 34 Gy in 3.4-Gy fractions
- 1255 (87%) had invasive breast cancer (IBC)

(median size, 10 mm)

- 194 (13%) had ductal carcinoma in situ (DCIS)

(median size, 8 mm).

- Median follow-up 54 months.

Vicini et al IJROBP 2011

Table 2. Patterns of failure

Parameter	All cases (n = 1449)*		Invasive cases (n = 1255)*		DCIS cases (n = 194)*	
	5 y, n (%)	5-y actuarial rate (%)	5 y, n (%)	5-y actuarial rate (%)	5 y, n (%)	5-y actuarial rate (%)
Breast only failures (IBTR)	35 (2.4)	3.65	31 (2.5)	3.77	4 (2.1)	2.85
Local and regional failures	2 (0.1)	0.16	1 (0.1)	0.10	1 (0.5)	0.56
All axillary failures	9 (0.6)	0.80	8 (0.6)	0.84	1 (0.5)	0.56
Distant failure	23 (1.6)	2.20	22 (1.8)	2.44	1 (0.5)	0.66
Disease-free survival	—	86.60	—	85.50	—	93.20
Overall survival	—	92.50	—	91.70	—	97.20
Cause-specific survival	—	98.80	—	98.50	—	99.40
Contralateral failure	19 (1.3)	1.94	17 (1.4)	2.04	2 (1.0)	1.29

- The percentage of breasts with good/ excellent cosmetic results (60 m) 90.6%.
- Symptomatic breast seromas 13.0% of cases
- Fat necrosis 2.3% cases

Vicini et al IJROBP 2011

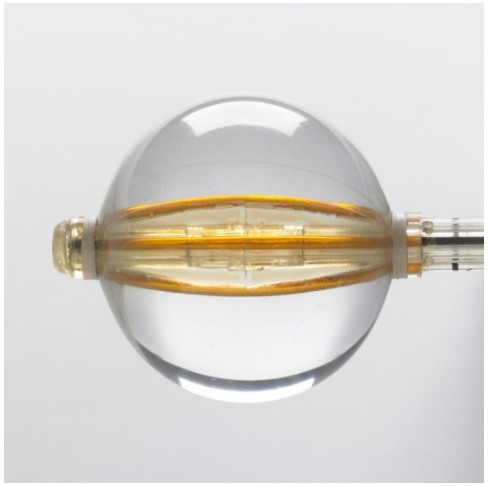
Mammosite specific limitations

- Issues with use in small breasts
- Issues with tumor beds close to the skin
- Reports of increased rib fractures

Common limitations of interstitial and mammosite

- Require 8 –10 fractions over 5 days, two fractions per day
- Resources and patient commitment remain significant
- Catheter placement usually requires a general
- anesthesia.

Contura Multilumen balloon



- Contura multilumen balloon (CMLB) (SenoRx, Inc., Irvine, CA)
- Fivelumen catheter introduced in 2007
- Simplicity of insertion and treatment delivery
- Increased dosimetric control and the ability to maximize target coverage
- Reduced dose to skin and rib
- Less dosimetric compromise.

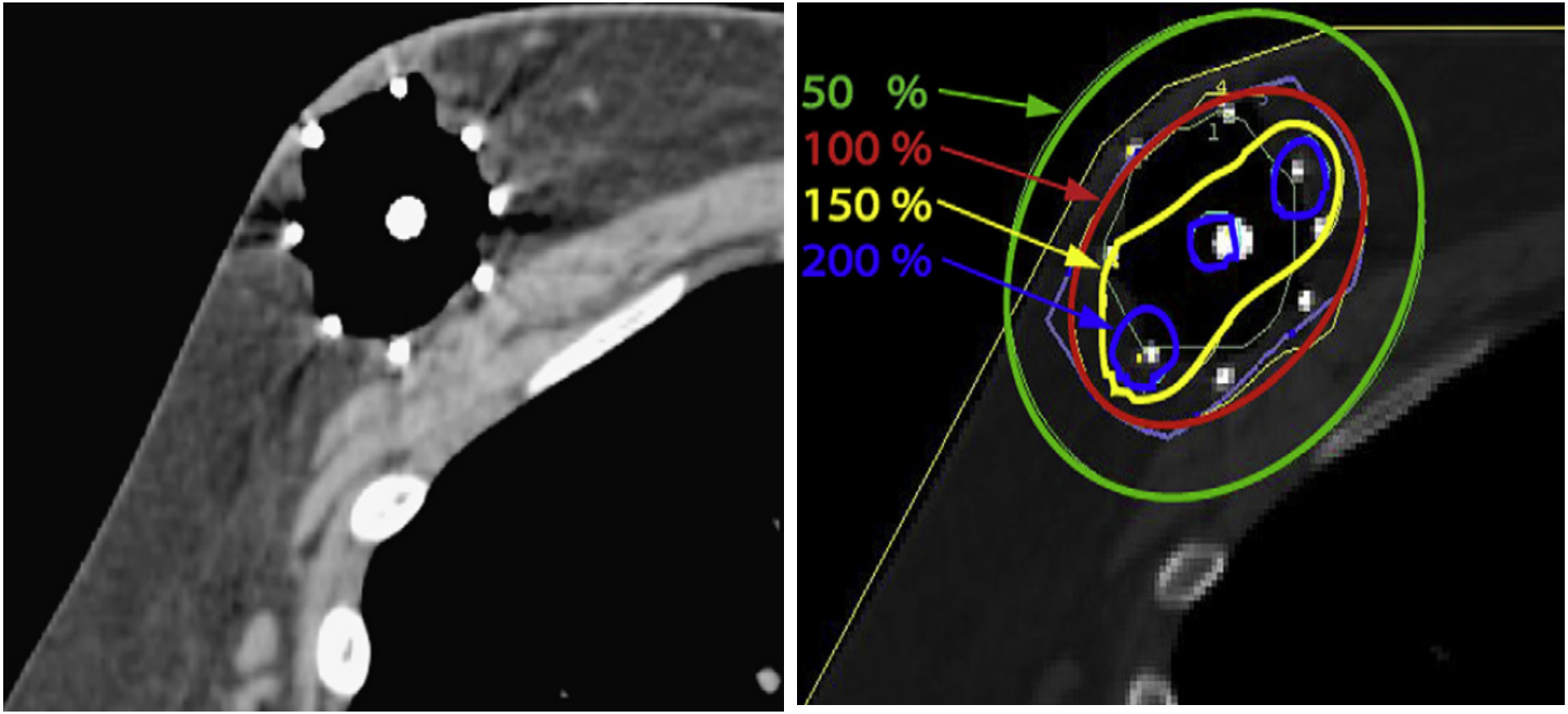
Arthur DW, IJROBP 2011


MUMBAI

Strut Adjusted Volume Implant (SAVI)

- Hybrid of Mammosite and IBT
- Central channel and peripheral channels
- 3 sizes- 7, 9, or 11 struts
- Allowing for expansive dose modulation near normal tissues, such as the skin, chest wall, and heart
- Advantage of loading individual channels
- Flexibility of dose optimisation
- 34Gy in 10 #, 1 cm beyond tumour edge

Planning /Dosimetry



Yashar et al, Brachytherapy 2009

SAVI results

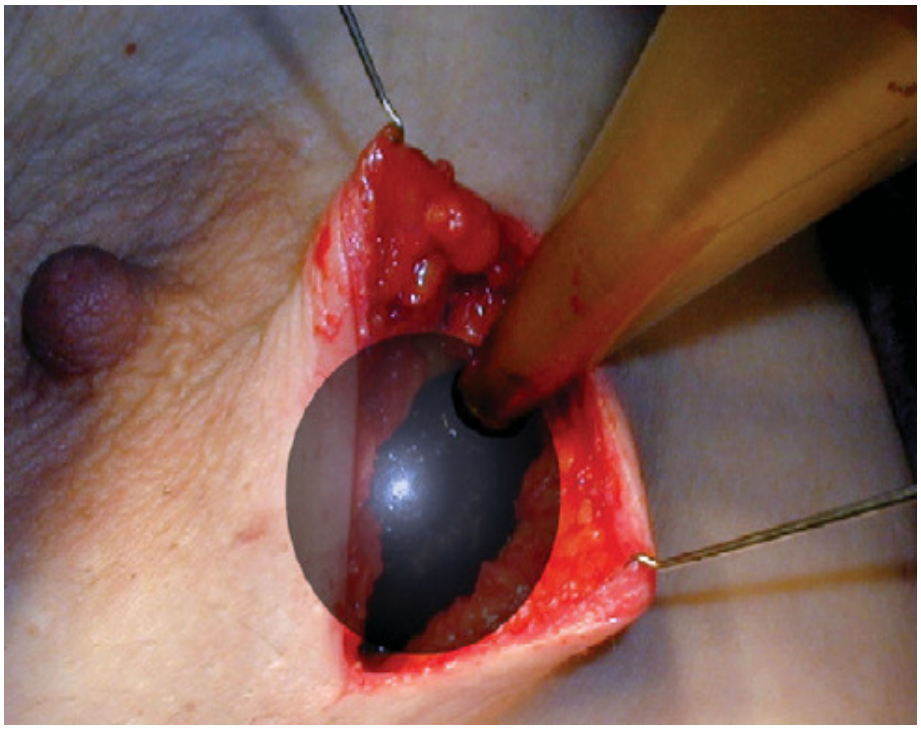
- 30 patients, median follow up -1yr
- V90 - 96.2% (82- 99.6%), V150 - 24.8 cc (8.2-40.6 cc), V200 -12.8 cc (3.7-18.7 cc)
- Symptomatic seromas- Nil
- Asymptomatic fat necrosis-1 (at 18 months)
- Local recurrences – None
- Cosmesis - Good to excellent in all the patients

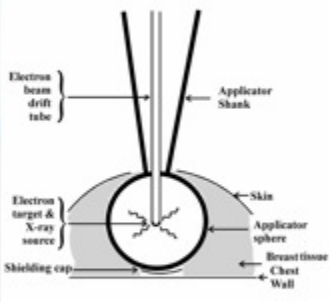
Yashar et al, Brachytherapy 2009

Targit device

- Intrabeam device provides a point source of low energy x-rays (50 kV maximum)
- Spherical tumour bed applicator.
- Surgical positioning of appropriately sized applicator in the tumour bed
- Radiation is switched on for 20–35 min
- Surface of the tumour bed typically receives 20 Gy that attenuates to 5–7 Gy at 1 cm depth

Targit device





Targeted intraoperative radiotherapy versus whole breast radiotherapy for breast cancer (TARGIT-A trial): an international, prospective, randomised, non-inferiority phase 3 trial

Jayant S Vaidya, David J Joseph, Jeffrey S Tobias, Max Bulsara, Frederik Wenz, Christobel Saunders, Michael Alvarado, Henrik L Flyger, Samuele Massarut, Wolfgang Eiermann, Mohammed Keshtgar, John Dewar, Uta Kraus-Tiefenbacher, Marc Sütterlin, Laura Esserman, Helle M R Holtveg, Mario Roncadin, Steffi Pigorsch, Marinos Metaxas, Mary Falzon, April Matthews, Tammy Corica, Norman R Williams, Michael Baum

Summary

Background After breast-conserving surgery, 90% of local recurrences occur within the index quadrant despite the presence of multicentric cancers elsewhere in the breast. Thus, restriction of radiation therapy to the tumour bed during surgery might be adequate for selected patients. We compared targeted intraoperative radiotherapy with the conventional policy of whole breast external beam radiotherapy.

Lancet 2010; 376: 91–102
Published Online June 5, 2010
DOI:10.1016/S0140-6736(10)60837-9

See Comment page 71

Targit - Concerns

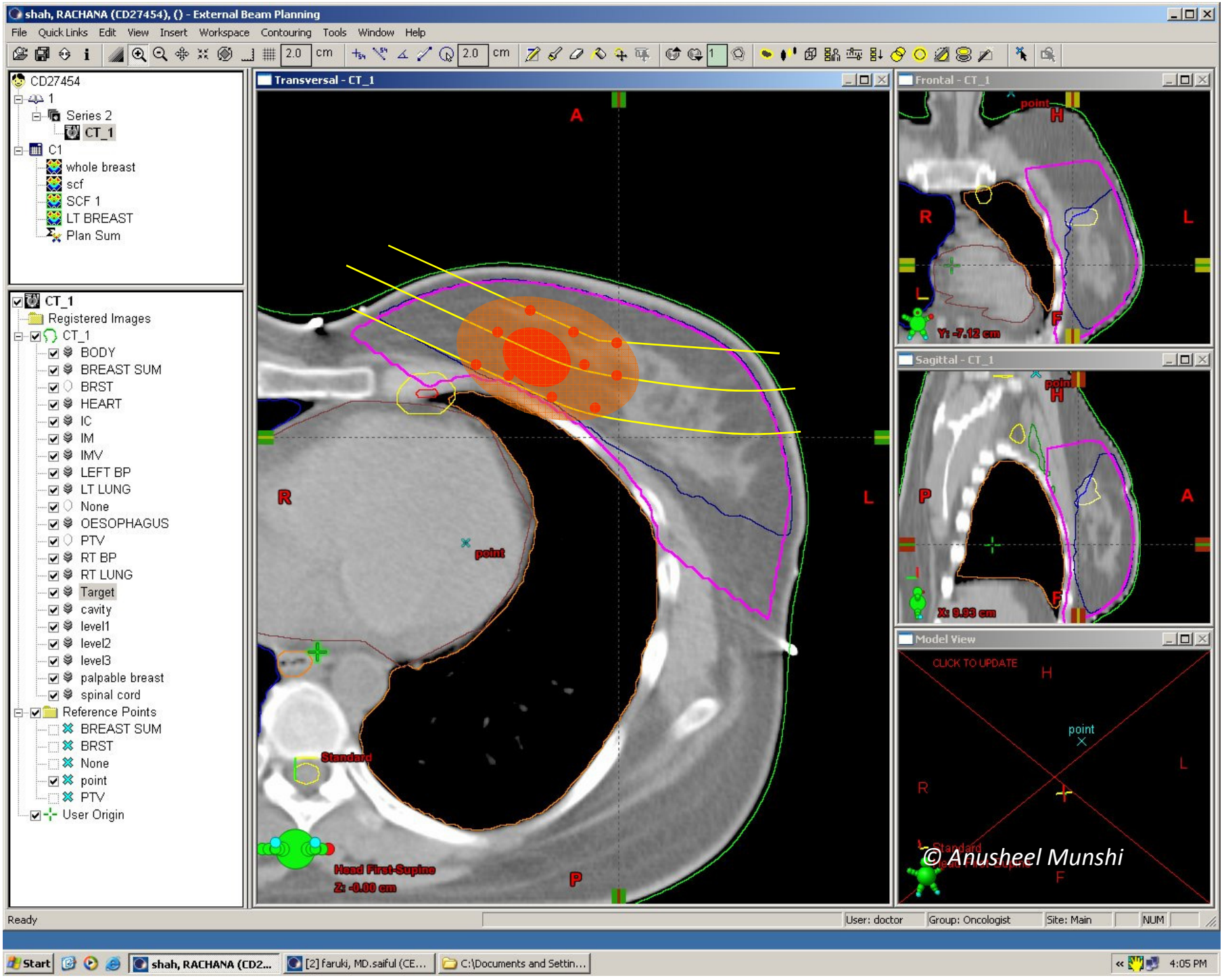
1. Prescription at 1mm from surface
2. Entire treatment completed during surgery (non availability of full pathological details)
3. Technique best suited only for small , regular cavities
4. Relatively short follow up

Interpretation For selected patients with early breast cancer, a single dose of radiotherapy delivered at the time of surgery by use of targeted intraoperative radiotherapy should be considered as an alternative to external beam radiotherapy delivered over several weeks.

Funding University College London Hospitals (UCLH)/UCL Comprehensive Biomedical Research Centre, UCLH Charities, National Institute for Health Research Health Technology Assessment programme, Ninewells Cancer Campaign, National Health and Medical Research Council, and German Federal Ministry of Education and Research (BMBF).

University Medical Centre Mannheim, University of Heidelberg, Heidelberg, Germany; School of Surgery, University of Western Australia, Perth, WA, Australia (C Saunders); Department of Surgery, University of California, San Francisco, CA,

Permanent Interstitial seeds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X: 9.83 cm
© Anusheel Munshi
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Permanent Breast ^{103}Pd Seed Implant (PBSI) as adjuvant partial breast irradiation.

J.P. Pignol, B. Keller, E. Rakovitch, R. Sankreacha, W. Que.
Department of Radiation Oncology, Sunnybrook and Women's College Health Sciences Centre, Toronto, Canada.

- Stranded 103Pd seeds implanted under ultra-sound visualisation
- Special custom template to guide the needle insertion.
- Dose of 90Gy was prescribed on the target volume.

Prelim experience (BPSI)

- 17 patients received BPSI
- An average of 71 seeds were implanted. 90Gy was prescribed on the target volume

Issues

1. Cost
2. Availability
3. Implantation technique
4. Lack of mature data

patients

- No subcutaneous/skin side effects

Pignol et al,2004

Summary

- Most mature data for catheter based interstitial APBI
- Non interstitial techniques present an exciting option
- Present an opportunity of simple placement and dose optimisation
- Both interstitial and non interstitial techniques are being challenged by hypofractionated XRT