Accelerated Partial Breast Irradiation

Dr Patricia Lillis MD, MHA,MSS

Marshfield Clinic

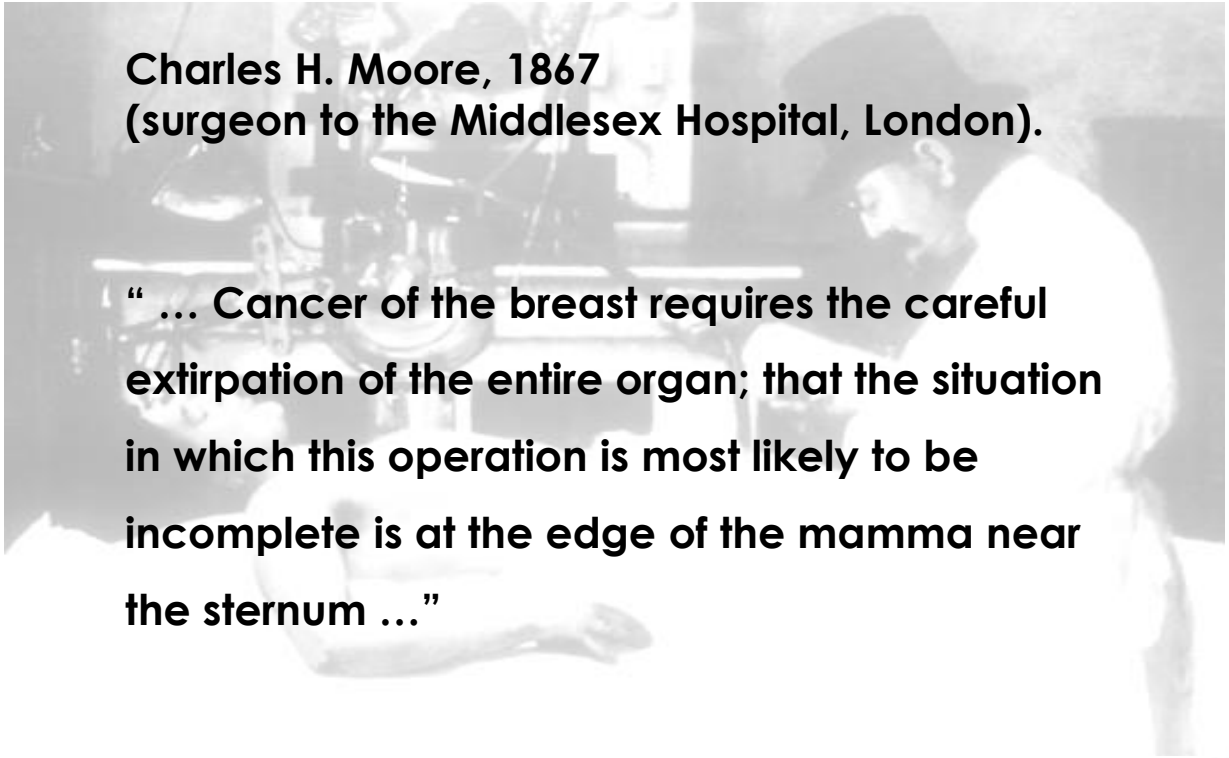
Radiation Oncology

Marshfield Clinic

Outline

1. Rationale
2. Review of selected literature
3. Technical aspects
4. Selection criteria
5. Ongoing questions and trials

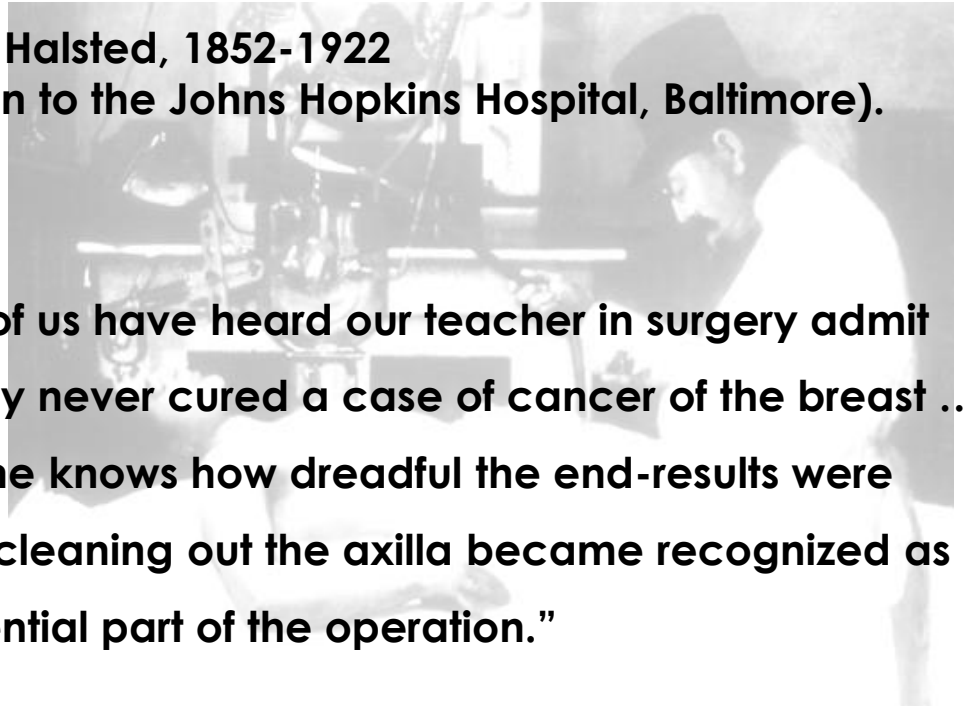
Early Investigations



Charles H. Moore, 1867
(surgeon to the Middlesex Hospital, London).

" … Cancer of the breast requires the careful extirpation of the entire organ; that the situation in which this operation is most likely to be incomplete is at the edge of the mamma near the sternum …"

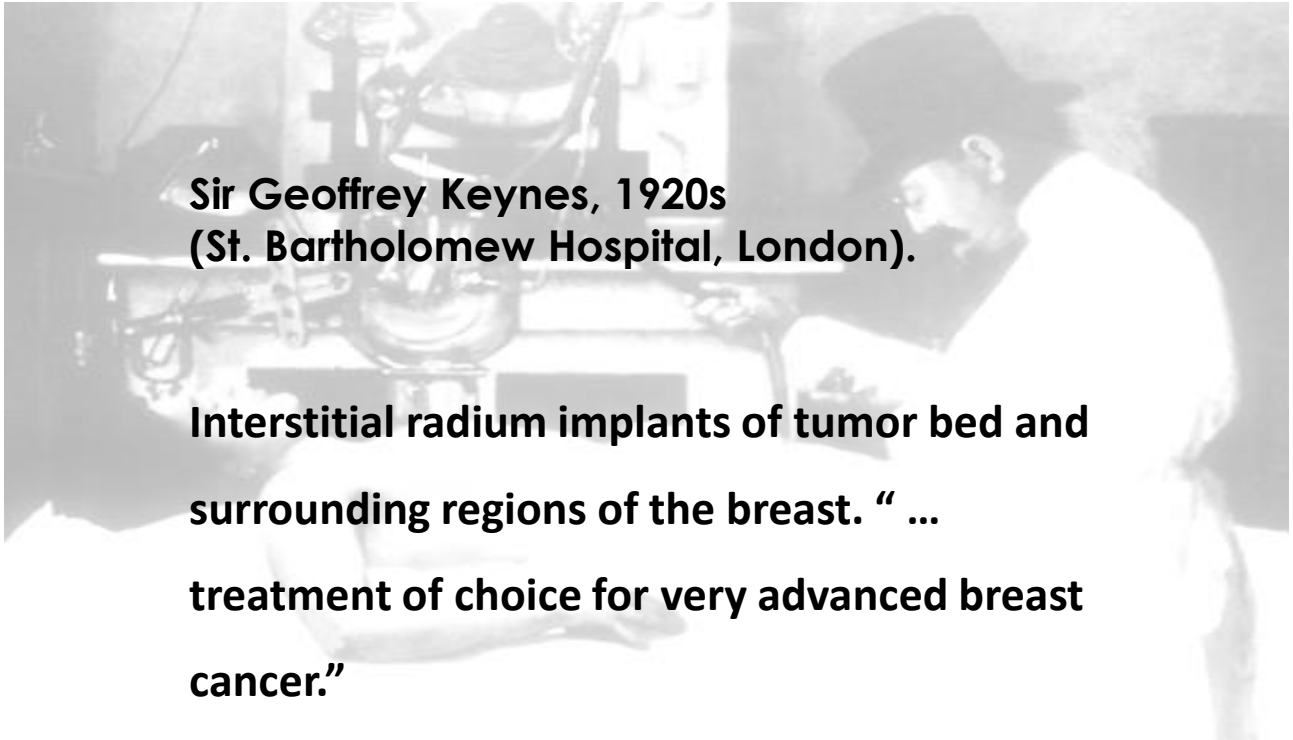
Early Investigations



William Halsted, 1852-1922
(surgeon to the Johns Hopkins Hospital, Baltimore).

“ Most of us have heard our teacher in surgery admit that they never cured a case of cancer of the breast … Everyone knows how dreadful the end-results were before cleaning out the axilla became recognized as an essential part of the operation.”

Early Investigations

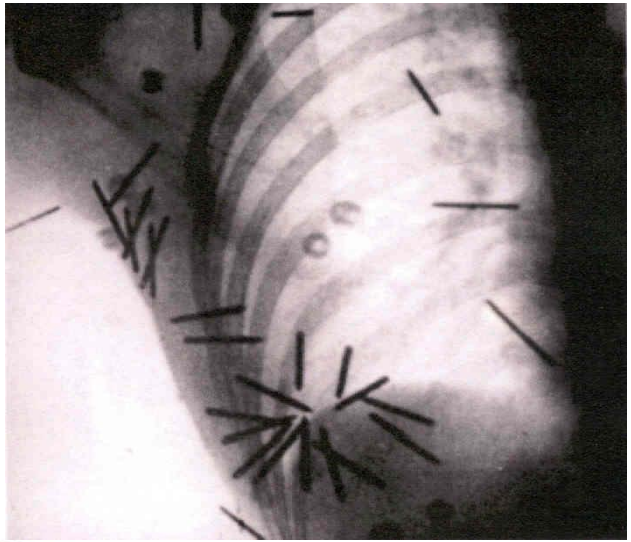


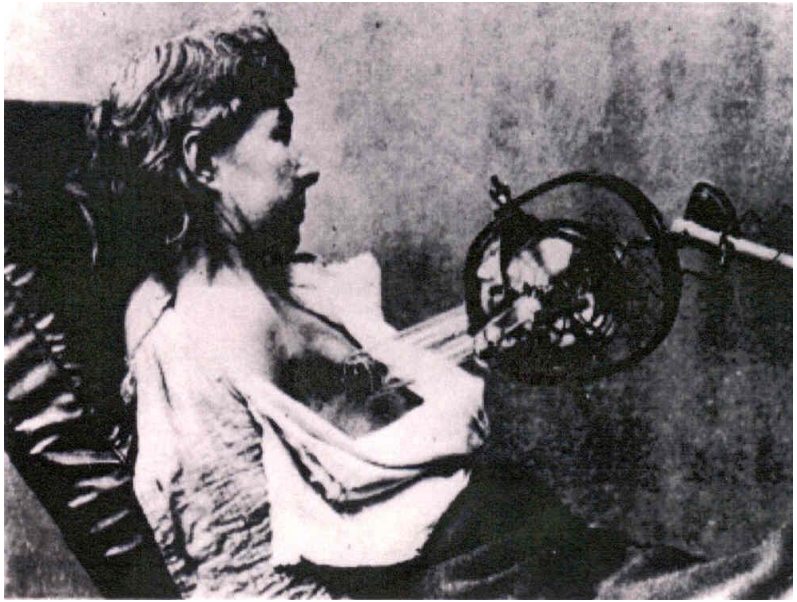
Sir Geoffrey Keynes, 1920s
(St. Bartholomew Hospital, London).

Interstitial radium implants of tumor bed and surrounding regions of the breast. " … treatment of choice for very advanced breast cancer."

Historical Perspective

Interstitial Radium Brachytherapy for Breast Cancer, 1917





Radiotherapy for Breast Cancer, London Hospital, c. 1917

Breast Cancer: Critical Benchmark Studies

- **NASBP (NEJM 2002: 347 1233-1241)**

20 year F/U shows

lumpectomy + XRT 14% LRR

lumpectomy alone 39.2% LRR

- **Milan (Ann Oncol 2001 12: 997-1003)**

Quadrantectomy + XRT 5.8% LRR

Quadrantectomy alone 23.5% LRR

Meta-Analysis of Breast Cancer XRT

Title: Effects of radiotherapy and of differences in the extent of surgery for early breast cancer on local recurrence and 15-year survival: an overview of the randomised trials

Early Breast Cancer Trialists' Collaborative Group (EBCTCG)

Lancet 366:2087-2106 (2005)

Meta-Analysis of Breast Cancer XRT

Meta-Analysis of 78 randomized controlled trials beginning by 1995. These trials included approximately 42,000 women and roughly ¾ were involved in XRT vs no XRT trials for either conservation therapy (intact breast) or post-mastectomy therapy. Trials separated into groups showing > or < 10% difference in LR.

From Lancet Meta-Analysis (N=42,000)

	XRT	No XRT
➢ **5 year local recurrence:** (conservation-intact breast)	7%	26%
➢ **Post-Mastectomy (LN+)**	6%	23%
➢ **15 year breast cancer mortality** (intact breast)	30.5%	35.9%
➢ **15 year breast cancer mortality** (post-mastectomy LN+)	54.7%	60.1%

- Overall all-cause reduction in mortality approx 4.4%!
- Similar proportional reductions in all groups

Marshfield Clinic

Techniques of APBI

- Interstitial implant brachytherapy
- Intra-Operative Radiotherapy
- External beam radiotherapy
- Intracavitary Brachytherapy

Breast Cancer: Critical Benchmark Studies

- NASBP (NEJM 2002: 347 1233-1241)

  20 year F/U shows

  lumpectomy + XRT 14% LRR

  lumpectomy alone 39.2% LRR

- Milan (Ann Oncol 2001 12: 997-1003)

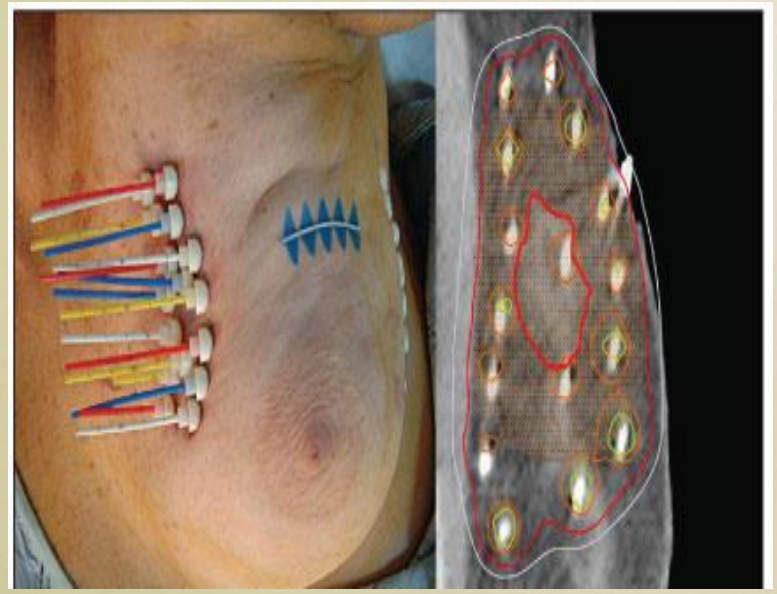
  Quadrantectomy + XRT 5.8% LRR

  Quadrantectomy alone 23.5% LRR

ASTRO APBI criteria

	Suitable	Cautionary
Age	≥ 50	40-49
Diagnosis	Invasive Ductal/DCIS	Pure DCIS, ≤ EIS; ≤ 3cm tumor
Tumor Size	≤2cm	2.1-3.0 cm
Surgical Margins	Negative by at least 2mm	Close (≤2mm)
Nodal Status	N 0 (i-, i+)	

Multi-catheter interstitial brachytherapy

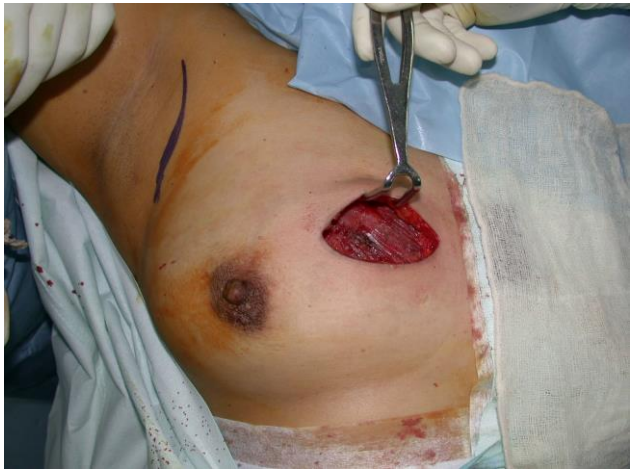


Marshfield Clinic

Method

Open procedure

- Direct visualization of the lumpectomy cavity/clips
- Free hand method
- After catheter placement, wound closure and position secured



Closed cavity implant

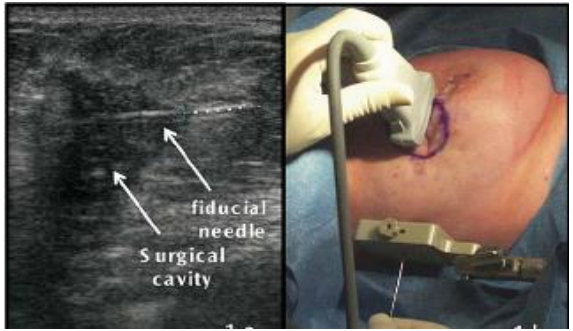
After the final pathology information to guide appropriate patient selection.

Local anesthesia given 15-30 min before the implantation.

Virtual planning

Simulator /CT based

- Appropriate number of catheters
- Number of catheter planes
- Optimal direction of placement.



Target volume

- Lumpectomy cavity plus a 2-cm margin
- Near chest wall and skin -1 to 1.5 cm

Dose

- HDR-34 Gy/10# bid in 5 days
- LDR- 45 Gy @ 50 cGy/hr over 4.5 days

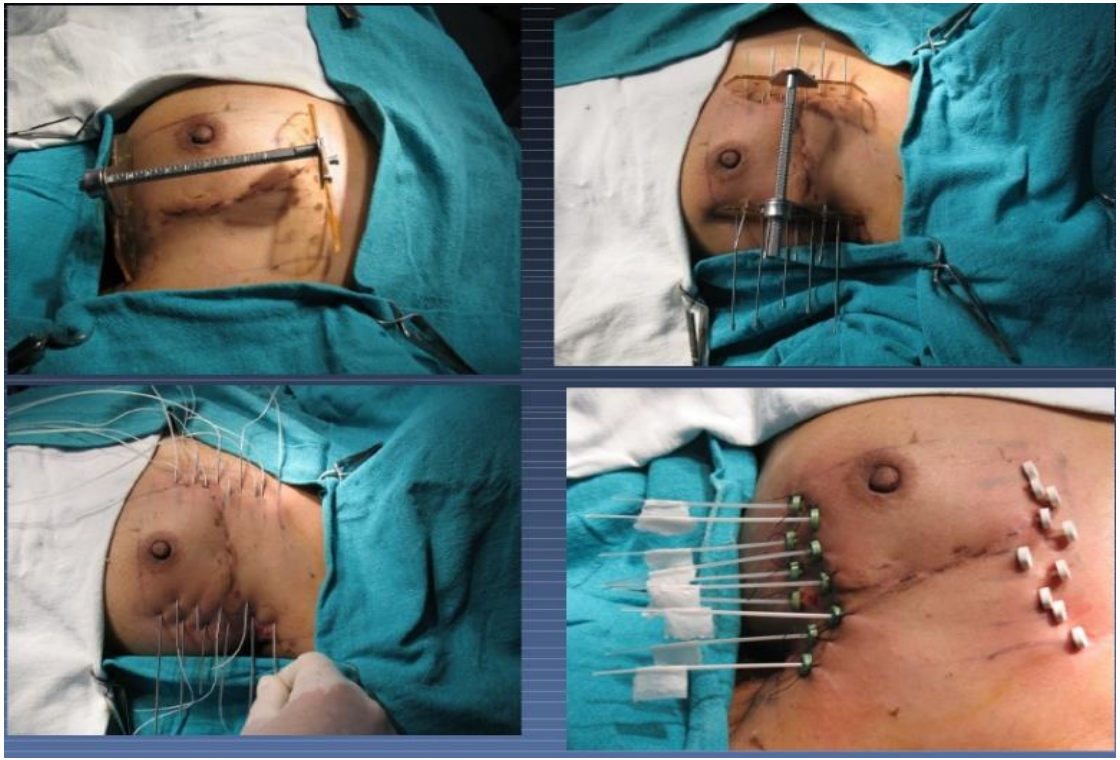
Arthur et al. IJROBP 2003 vol 56, 681-9

Catheter implantation

- Free hand technique
- Template to ensure even needle spacing

Using image guidance

- Ultrasound
- Fluoroscopy
- CT Scan



Marshfield Clinic®

Design of the implant geometry

Needles are implanted parallel and equidistance from each other (Paris system).

In most cases inserted in a mediolateral direction.

In very medially or laterally located tumor sites, needles should be implanted in a craniocaudal direction to enable separate target area from skin points.

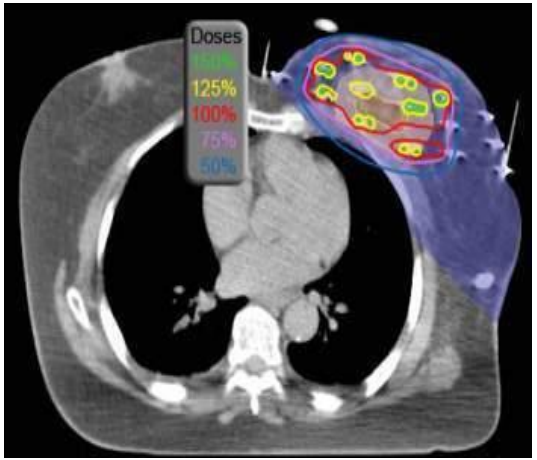
In some rare cases, the upper outer quadrant has to be implanted with needles orientated in a 45° angle to avoid overlap of source positions and skin

- 2 planes of needles are usually needed to cover the PTV.

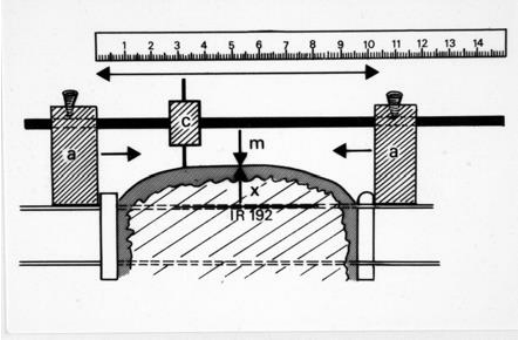
- Single plane < 12 mm.

- Three planes are required in a large breast where the targeted breast tissue between pectoral fascia and skin is thicker than 30 mm.

- Five to nine needles spaced 15–20 mm are usually required.



Reduction in skin dose



Skin to source measuring bridge is used.

If the superficial needles are too close to the skin, the templates are moved towards each other so that the overlying skin moves up and away from the needles.

If this is not sufficient, templates with a smaller spacing between the needles are used, resulting in compression of the breast tissue and upward movement of the skin

Some gauze is disposed between the templates and the skin of the thoracic wall at both sides of the implant to avoid skin necrosis secondary to continuous pressure of templates.

Advantages

- Has the longest follow-up.

- Better control and tailoring of radiation-dose delivery to variations in lumpectomy cavity, shape, or location within the breast.

- Limits toxicity to healthy tissue while delivering the maximum dose to at-risk tissue.

- Critical structures can be avoided by differential loading of the catheters

Limitations

- Considerable training and experience
- Appearance and patient acceptance of multiple catheter implants in the breast
- high skin dose: great care is required to ensure adequate source-to-skin distance in patients treated with brachytherapy

Therefore, may not be a viable treatment option for patients with superficial tumors or small breasts

results

Table 1 Results of recent clinical experience with Interstitial brachytherapy with more than 5 years follow up

Author	No of cases	Follow up interval (years)	Dose rate/pt no	Scheme	Total dose (Gy)	5-year LR (%)	Good/Excellent cosmesis
Strnad et al.[60]	274	5.25	PDR/HDR	PDR = 0.6 Gy/hr HDR = 4 Gy x8	PDR = 50 Gy HDR = 32 Gy	2.9%	90%
Antonucci et al. [59]	199	9.6	LDR/HDR	LDR 0.52 Gy/h × 96 hours HDR = 4 Gy x8 HDR = 3.4 Gyx10	LDR = 50 Gy HDR = 32 Gy HDR = 34 Gy	5%	99%
Johansson et al.[61]	50	7.2	PDR	50Gy/5	50	4%	56%
Arthur et al.[62]	99	7	LDR/HDR	LDR = 3.5 -5 days HDR = 3.4 × 10	45 Gy (LDR) 34 Gy (HDR	4%	n/a
Polgar et al.[63]	128	6.8	HDR	5.2 × 7	36.4 Gy	4.7%	77%
King et al [64]	51	6.25	LDR/HDR	LDR = 4 days 4 Gyx8	45 Gy (LDR) 32 Gy (HDR)	3.9%	75%
Otto et al. [65]	274	5.25	PDR/HDR	PDR 5 days, 0.6 Gy/hr HDR = 4 Gyx8	49.8 Gy (PDR) 32 Gy (HDR)	2.9%	92%
Polgar et al.[58]	45	11.1	HDR	4.33 × 7 5.2 × 7	30.3 Gy 36.4 Gy	4.4%	78%

LR = local recurrence, HDR = high dose rate, LDR = low dose rate, PDR = pulsed dose rate, n/a = data not available

Njeh et al. Radiation Oncology 2010,5:90

Radiotherapy and Oncology xxx (2013) xxx–xxx

Contents lists available at SciVerse ScienceDirect

Radiotherapy and Oncology

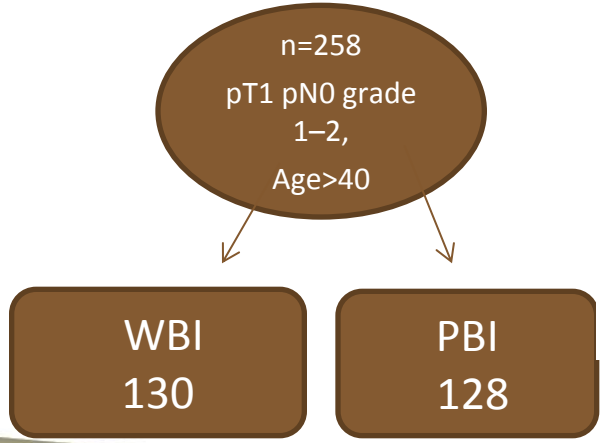
journal homepage: www.thegreenjournal.com

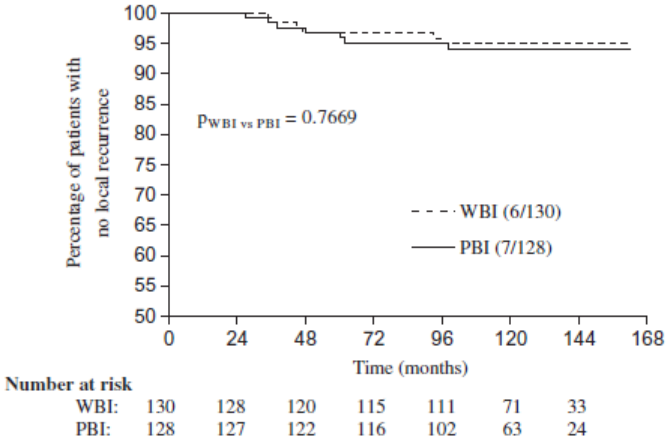
Original article

Breast-conserving therapy with partial or whole breast irradiation: Ten-year results of the Budapest randomized trial

Csaba Polgár [a,*], János Fodor [a], Tibor Major [a], Zoltán Sulyok [b], Miklós Kásler [c]

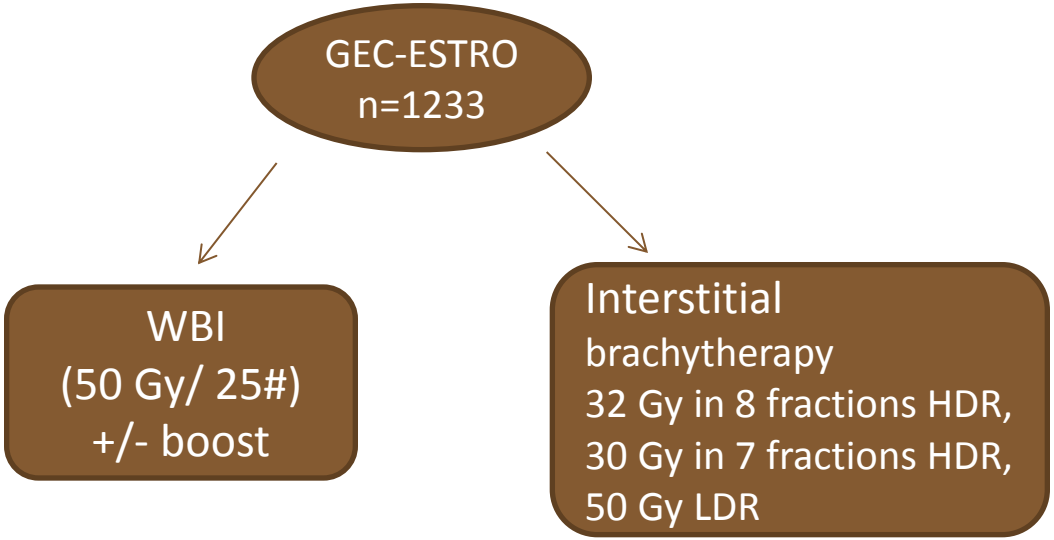
[a] Center of Radiotherapy; [b] Center of Surgery; [c] National Institute of Oncology, Budapest, Hungary





Marshfield Clinic

Ongoing Trial (interstitial) in Europe



- >40 years,
- Stages 0-II (T < 3 cm),
- DCIS or invasive adenocarcinoma
- Node negative or with micro-metastasis
- Margin 2 mm

Accrual completed, Results awaited

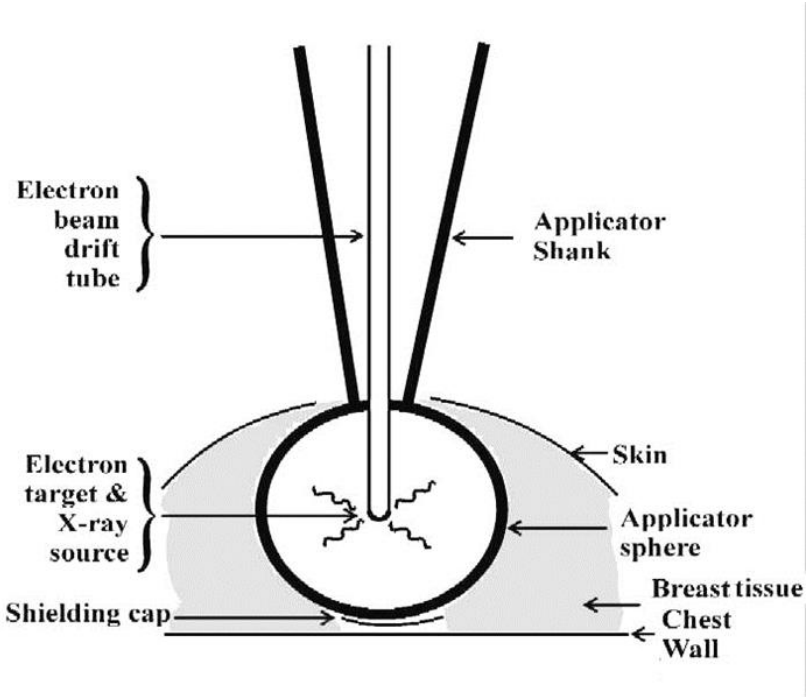
Intra-Operative Breast Irradiation

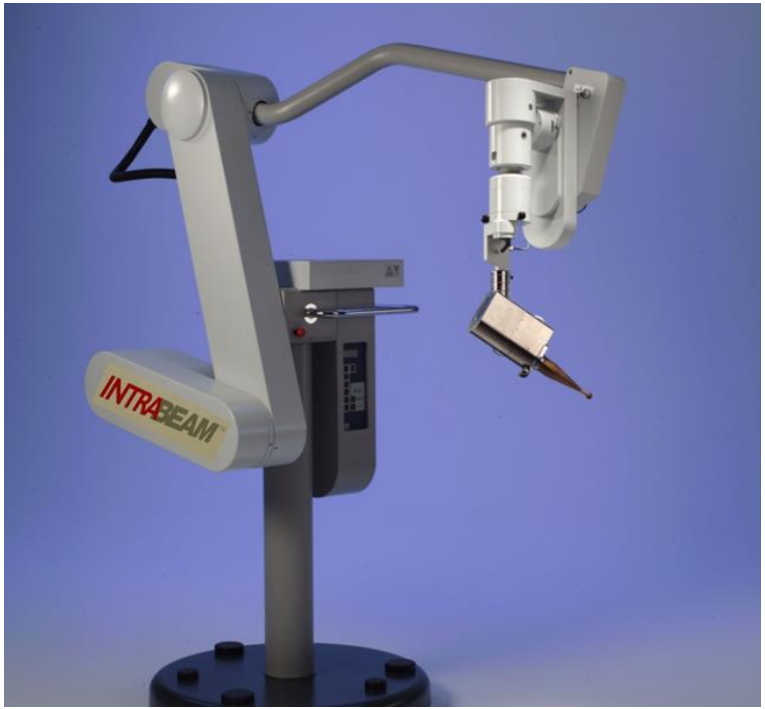
Marshfield Clinic

Intraoperative Radiation Therapy (IORT) for PBI

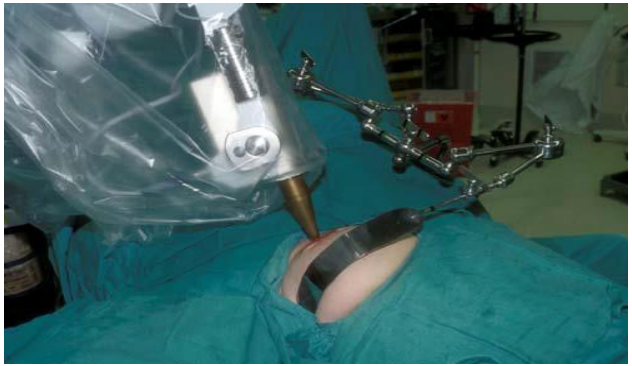
- TARGIT trial is comparing whole breast irradiation to IORT delivering a single dose of 20 Gy. Primary accrual is in Europe
- Using the Intrabeam Photon Radiosurgery System, 50 kV x-rays.
- Trial has enrolled 900 patients with target of 2200 patients.

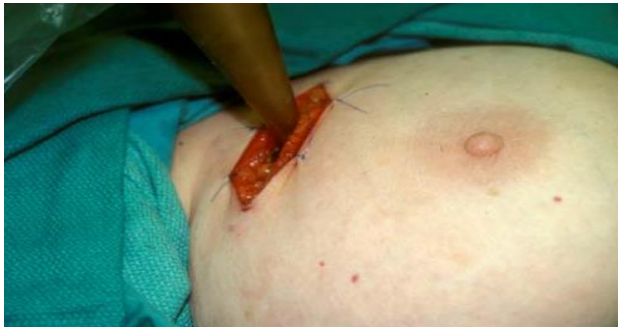
Zeiss Intrabeam®





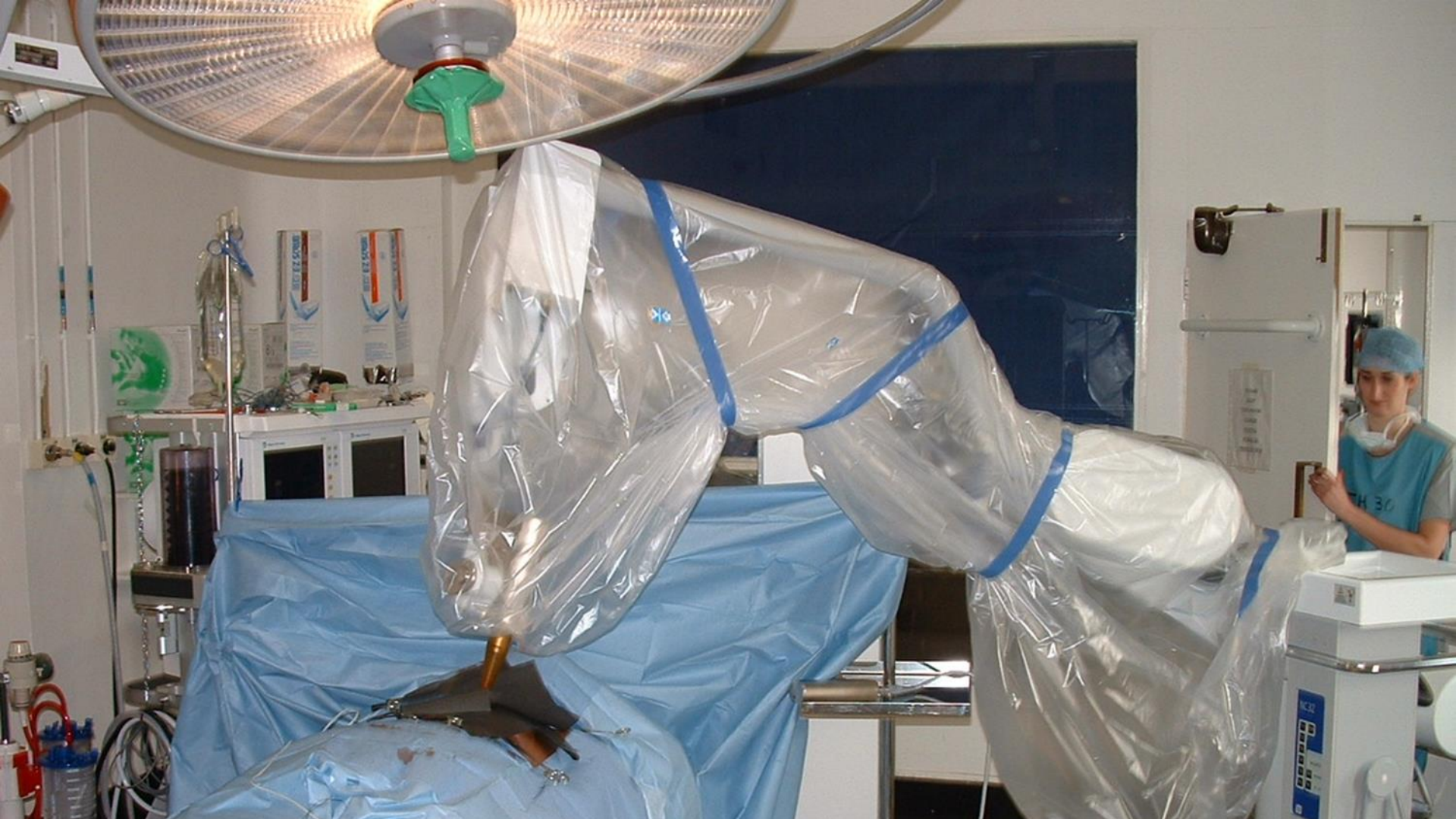
Intra-Operative Breast Irradiation

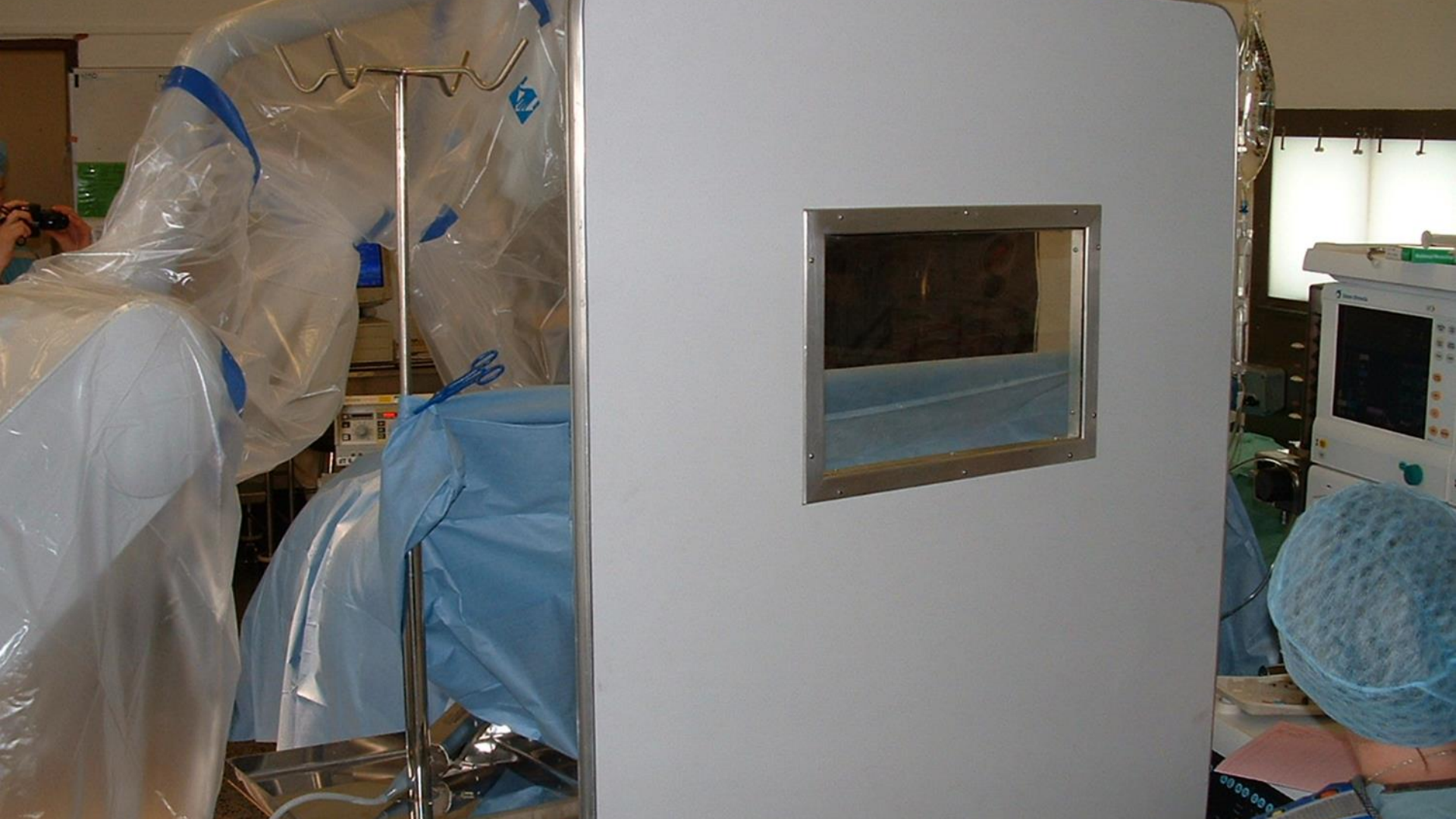




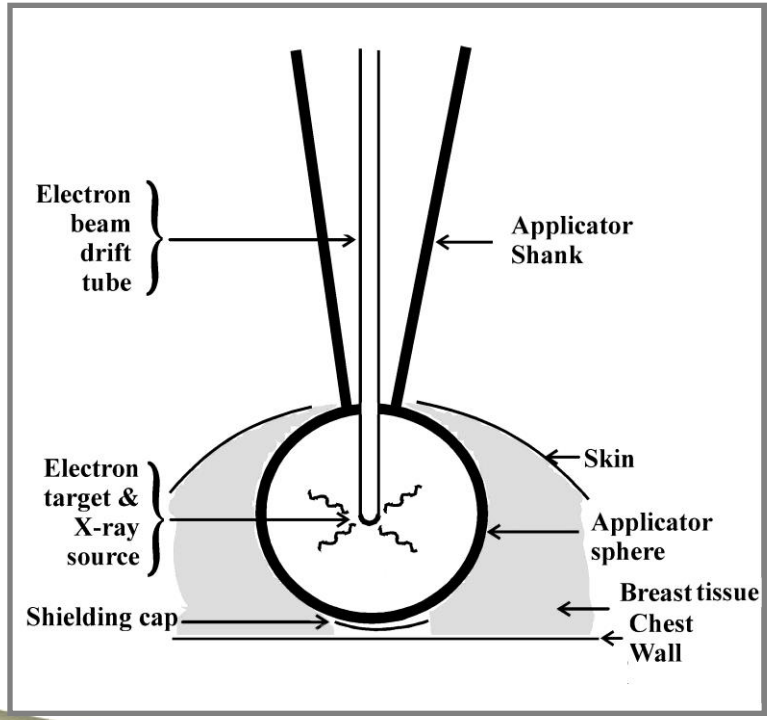
- London study using Intrabeam device (Photo Electron, now owned by Zeiss)
- Spherical applicators of different sizes
- 50 kv orthovoltage beam producing 5 Gy at 1 cm from application surface
- Clinical trial by Tobias et al. now underway; each site chooses its own entrance criteria.
- Other intra-op programs at MSK, etc.

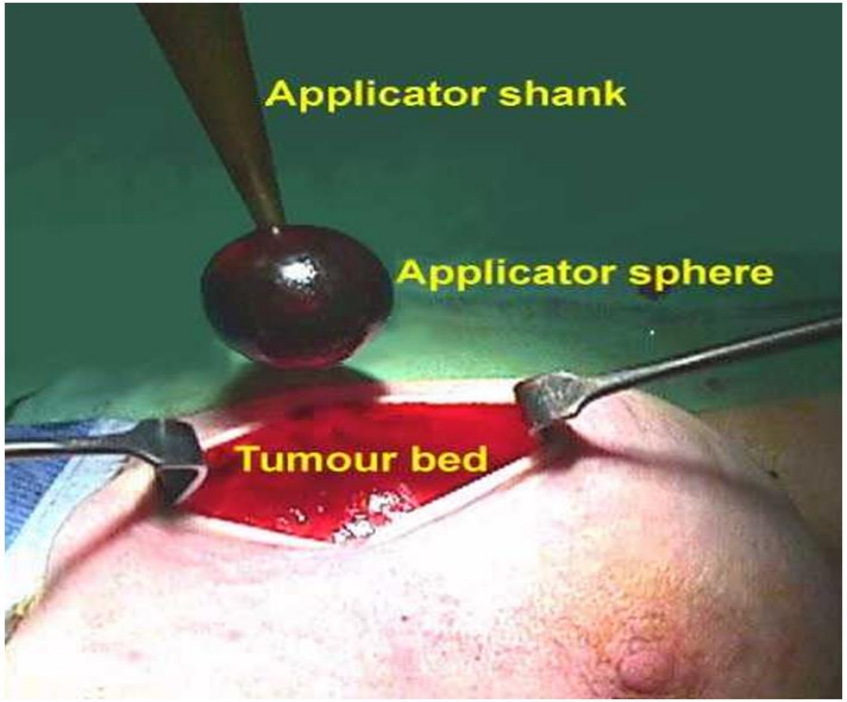
CCF used for boost only. Veronesi (Milan) just published results of 590 pts treated with intra-op electron beam; 21 Gy single fraction. 3% breast fibrosis, 6/590 ipsilat. recurrence after 2-year median f/u. [Ann. Surg 242:101 2005





Spherical Applicator 1.5-5cm with uniform surface dose Rate





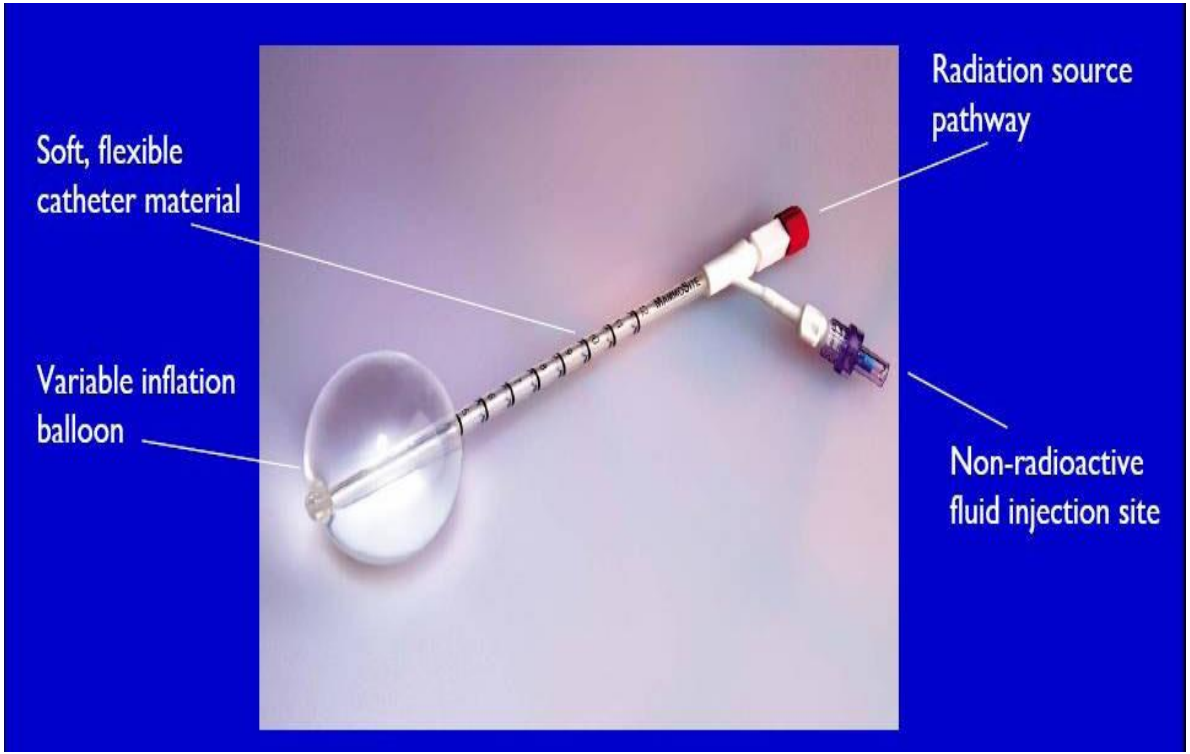
Intracavitary Brachytherapy

Marshfield Clinic

Balloon based brachytherapy include:

- Mammosite
- Contura
- SAVI
- Axxent electronic brachytherapy

Mammosite brachytherapy system



structure

Silicone balloon

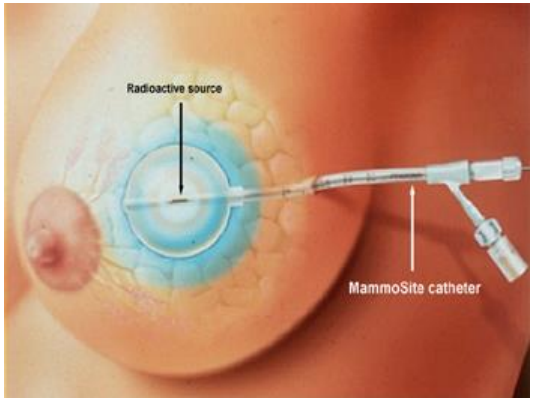
Double-lumen catheter (15 cm length and 6 mm in diameter)

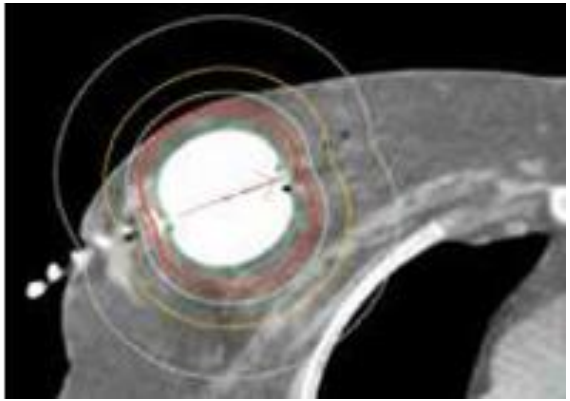
Inflation channel:- saline solution mixed with a small amount of contrast material to aid visualization.

Source channel:- for passage of an Ir-192 high dose rate (HDR) brachytherapy source.

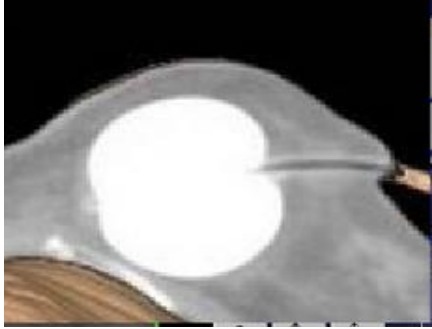
Source channel runs centrally through the length of the balloon.

- Post lumpectomy, the catheter is placed in the breast cavity either during the lumpectomy procedure or later through a closed technique
- balloon is inflated with 35-70 mL of saline plus a small amount of contrast material, depending on the size of the lumpectomy cavity
- CT imaging to assess the adequate placement of the device
- An Ir-192 radioactive source, connected to a computer-controlled HDR remote after-loader delivers the prescription radiation dose



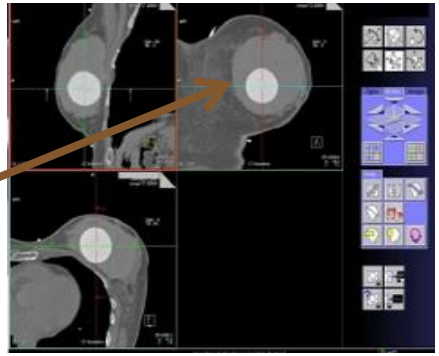


Quality of the implant

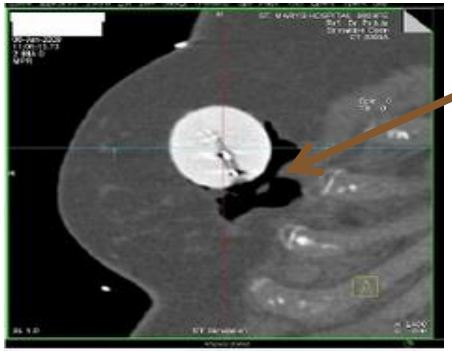


- Balloon Conformance: assessed by quantifying the volume of the PTV that is filled by air or seroma fluid.

- Less than 10% of the PTV should be composed of fluid or air.



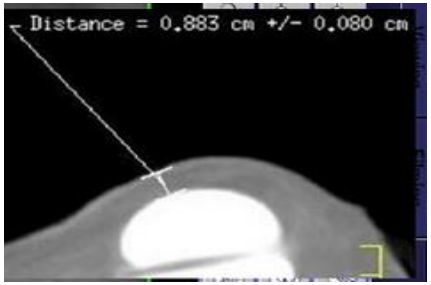
Large seroma

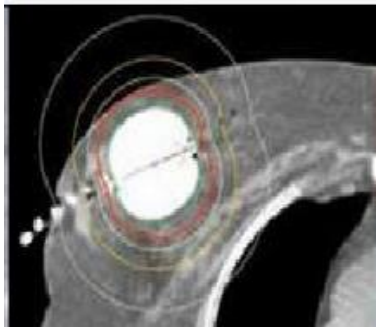


Too much air

- **Minimum balloon-to-skin distance**: for good cosmesis

  5-7 mm is required

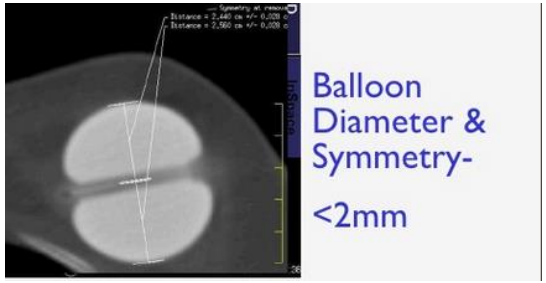


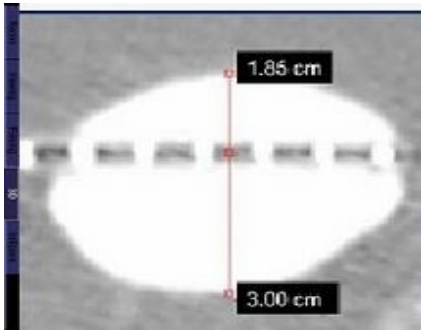


Close to the skin

Symmetry

- Is essential for adequate dosimetry.
- A non-symmetrical implant can result in dose inhomogeneity in the surrounding tissues since the MSB device contains a single, central source channel that does not allow for shaping of the radiation isodose curves in the direction perpendicular to the central channel





Asymmetrical

Dose

- 34 Gy over 10 fractions

- Minimum 6 hours between fractions

- D 90> 90%
- V150< 50cc
- V200< 20 cc
- Skin dose Max <145%

Limitations

- Not suitable in patients with small breast .
- Tumors located in the upper-inner quadrant.
- Irregular cavity .
- Requirement for skin-to-cavity distances too small –superficial tumor

Results of mammosite

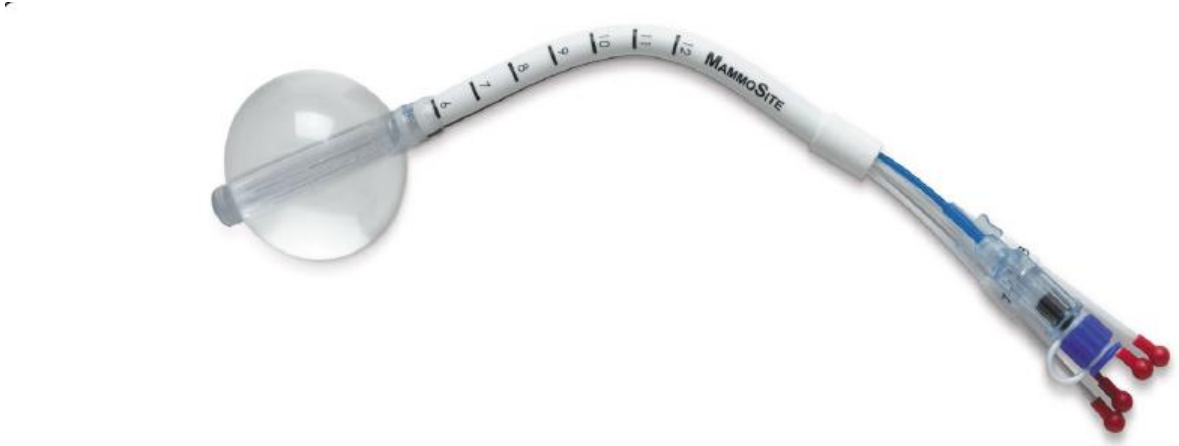
Author	No of cases	Median follow up interval (months)	IBF	Good/ Excellent cosmesis
Benitez et al.[73]	43	65	0%	81.3%
Niehoff et al [69]	11	20	0%	n/a
Patel et al.[75]	26	48.5	0%	n/a
Vicini et al.[71]	1440	30	1.6%	95%
Chen et al.[76]	70	26.1	5.7%	n/a
Belkacemi et al. [77]	25	13	0%	84%
Voth et al.[78]	55	24	3.6%	n/a
Dragun et al. [70]	90	24	2.2%	90%
Vicini et al.[79]	1440	60	2.6%	90.6%
Jeruss et al. [74]	194$	54.4	3.1%	92%

n/a data not available, IBF = ipsilateral breast failure, $ these are ductal carcinoma in situ (DCIS) patients recruited in the American Society of Breast Surgeons APBI registry trial.

Njeh et al. Radiation Oncology 2010, 5:90

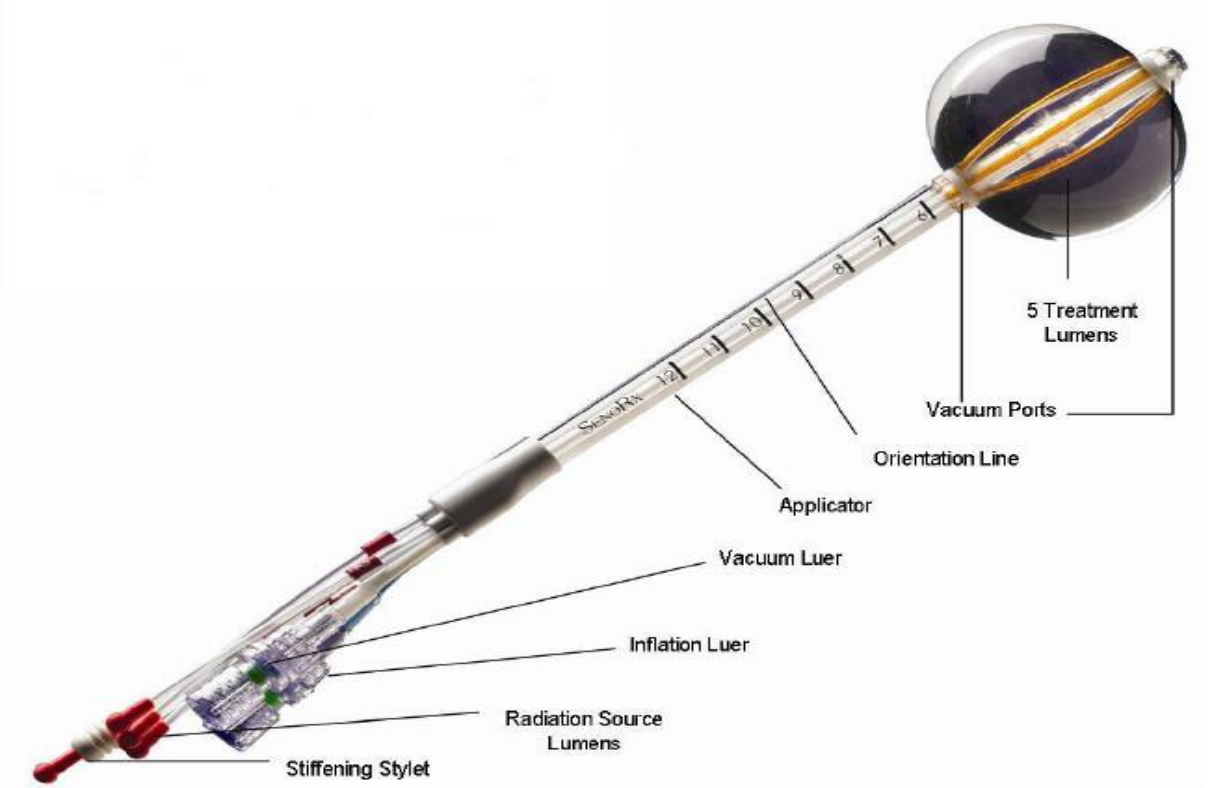
Contura

MammoSite Multi-lumen (4 lumen) device



Marshfield Clinic

contura

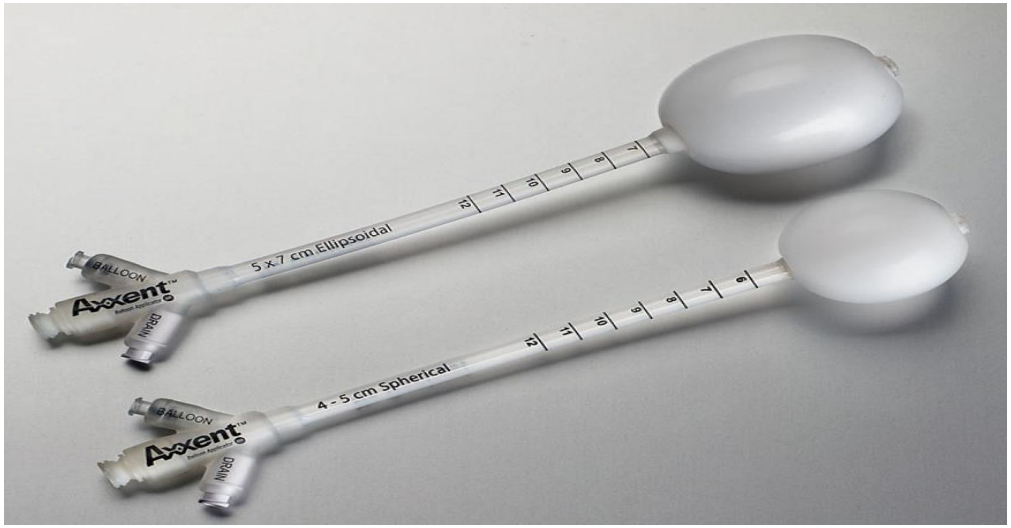


Marshfield Clinic

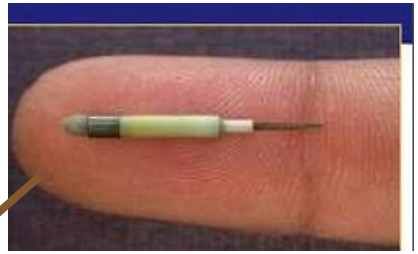
Balloon based brachytherapy include:

- Mammosite
- Axxent electronic brachytherapy
- Contura

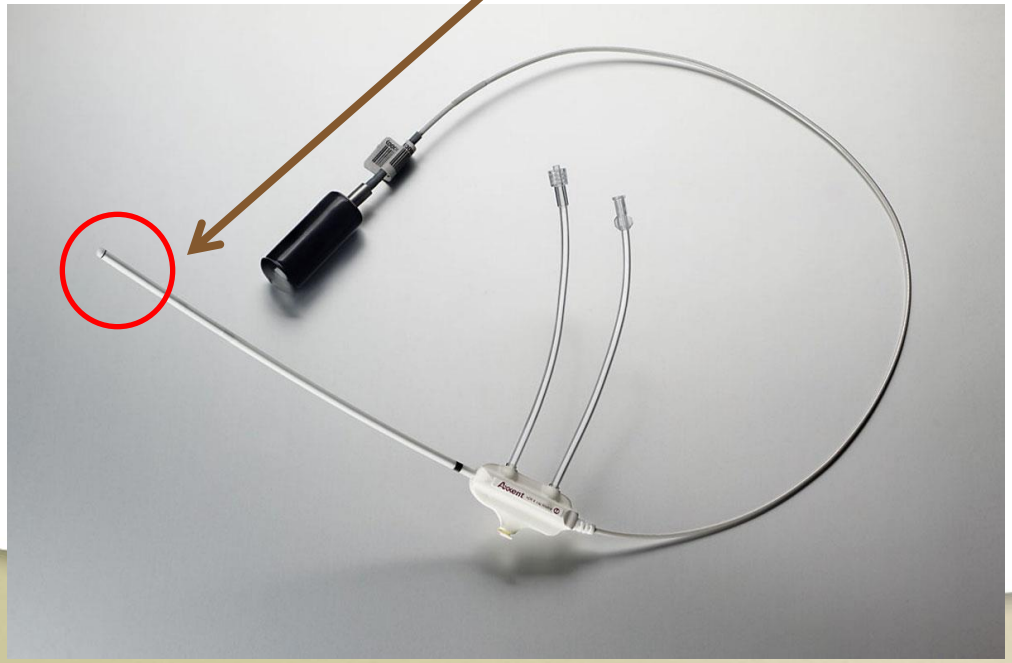
Axxent electronic brachytherapy



Ballon is radiolucent :- No need of contrast
Holes in the ballon
Third port for drainage of seroma fluid or air surrounding the cavity.



Miniature
X-ray source



Marshfield Clinic

eB controller

- Portable unit

- Digital touch-screen for the Physician and Physicist to input treatment data and monitor treatment progress.

Advantages

- Specifically shielded radiation room or an HDR afterloader unit are not required.

- This reduces costs and allows for portability of the system, which can lead to greater access for patients particularly in more remote or rural locations.

- Can be used intraoperatively

Electronic 50 Kv x-ray source

- **Low energy spectrum** that results in more rapid dose falloff with depth in tissue.
- Radiobiologic effect (RBE) for low-energy photons is higher on the order of 1.2-2.
- This has currently not been taken into account in the prescribed dose for EBB, which uses the same prescription of 34.0 Gy in 10 fractions as used with 192Ir.
- Dose to structures proximal to the point(1 cm) is higher and the dose to structures beyond this point is lower with EBB
- Careful clinical evaluation is needed to determine the clinical impact of these factors with respect to late tissue affects and cosmesis.

- In addition to a central lumen, the Contura balloon has four surrounding channels to accommodate the HDR source.

- Additional source positions allows increased dose flexibility compared with a single-catheter approach.

- Vacuum port to remove fluid or air around the lumpectomy cavity.

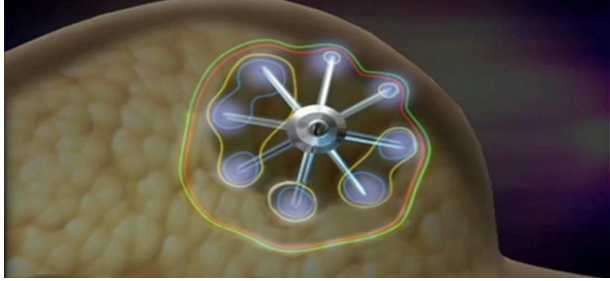
- Reduce the dose to normal tissues (chest wall and skin) better protection of organs at risk such as the heart and lungs.

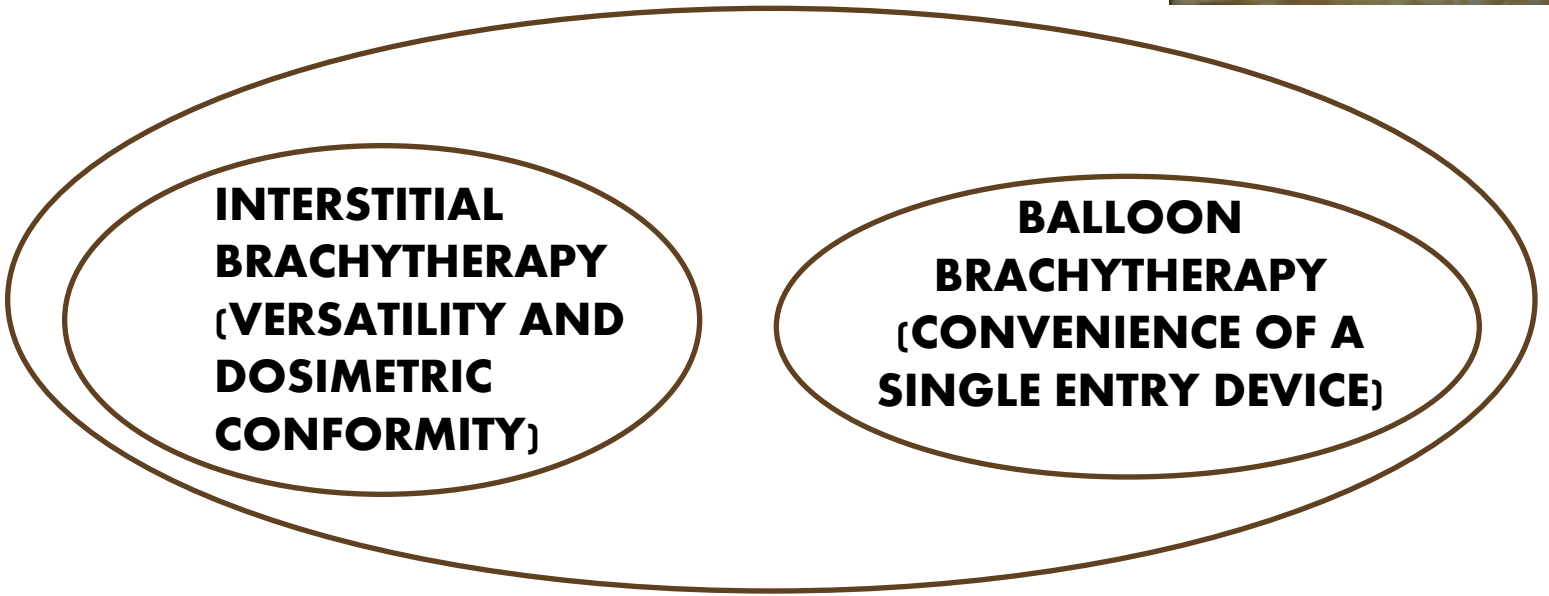
- Possible to account for asymmetric balloon implant with respect to the central channel.

Hybrid brachytherapy devices

Struts Adjusted Volume Implant
(SAVI)

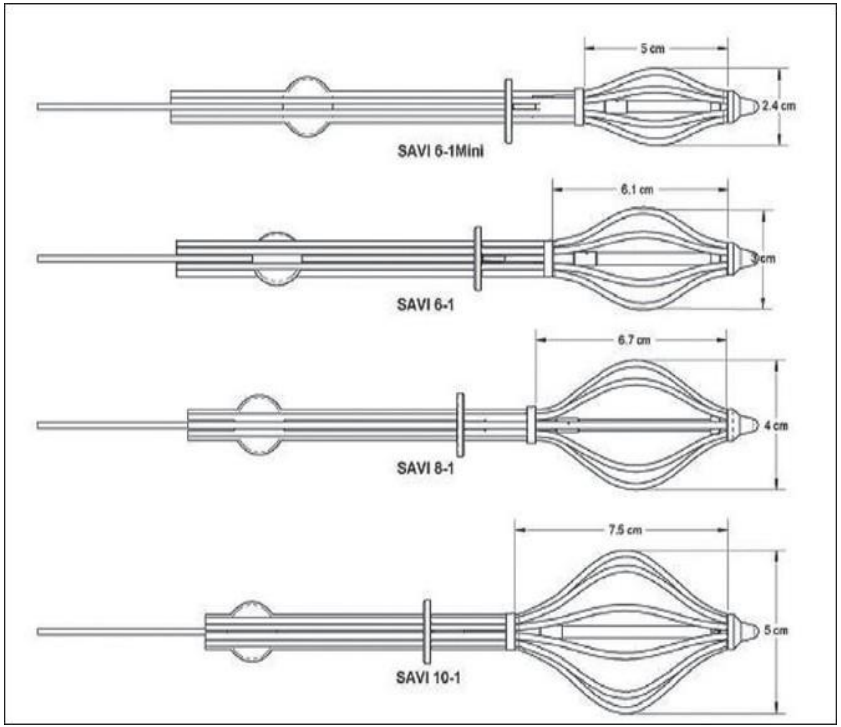
Marshfield Clinic





HYBRID DEVICES

Strut Adjusted Volume Implant (SAVI)



- Contains six outer expandable plastic tubes to displace the tissue
- Central catheter surrounded by six additional catheters that allow the passage of an HDR iridium-192 source
- The radiation source is not in direct contact with the breast tissue

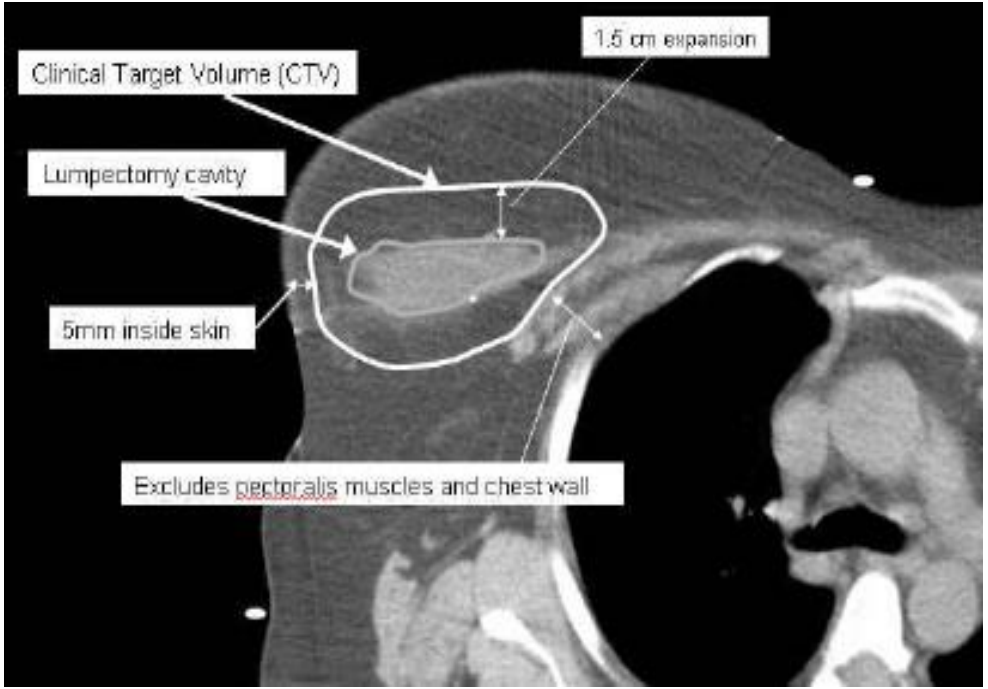
CLEARPATH

- Consists of a central strut Surrounded by 6, 8 or 10 peripheral struts
- Can be differentially loaded with HDR source
- Insertion done in collapsed form through an incision (freehand; USG guided)
- Then expanded to fit the cavity
- CT required (verification and planning)

EBRT (IMRT)

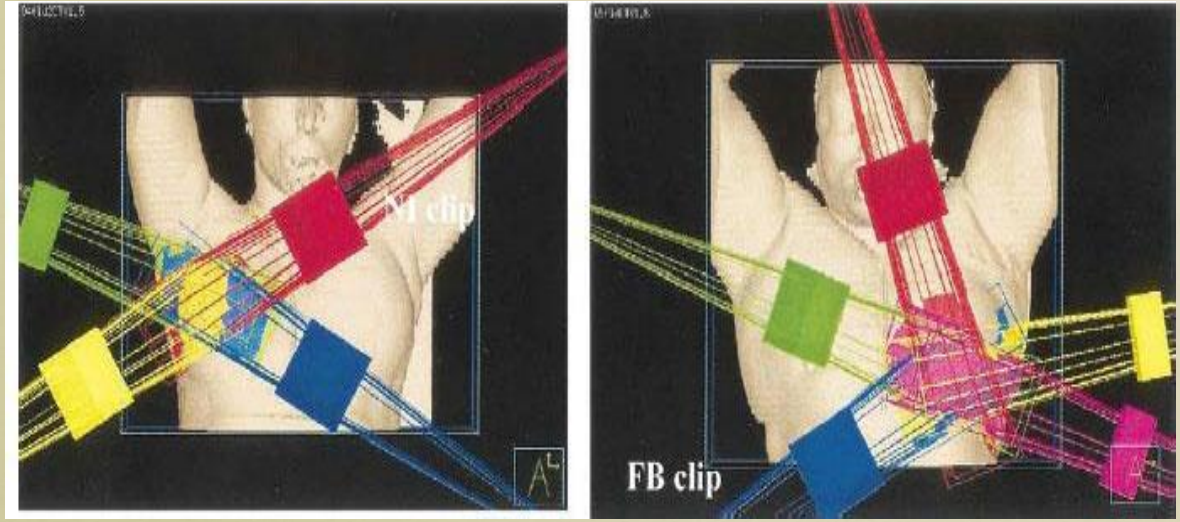
advantages

- Non-invasive (complications of surgery like seroma and infection can be avoided)
- Widespread availability
- Technically less demanding
- Treatment results with external beam may be more uniform between radiation oncologists
- Greater dose homogeneity



3.85 Gy twice daily (separated by at least 6 hours) to a total dose of 38.5 Gy delivered within 1 week

External beam radiotherapy
3D-CRT/ IMRT



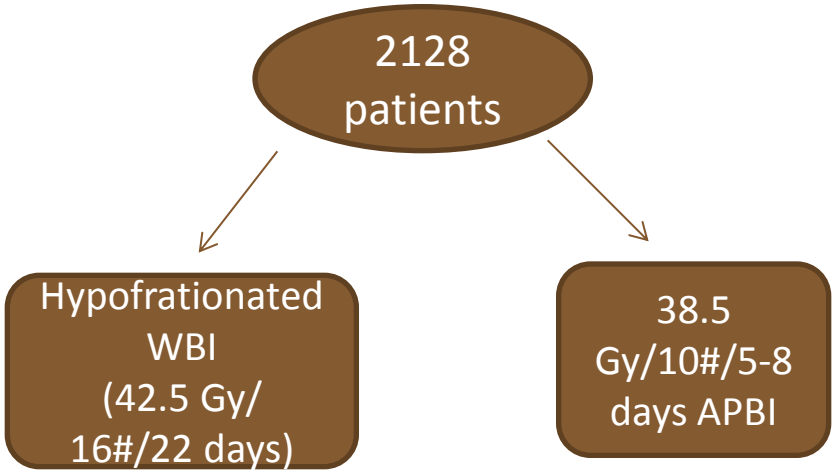
Marshfield Clinic

planning

- CTV – tumor bed on CT , including surgical clips plus 1 cm margin inside breast tissue
- PTV- CTV + 1 cm margin
- Prescribed dose 38.5 Gy in 10 # bid over 5-8 days/ minimum interfraction interval 6 hours
- The breast volume planning goals
  - 0% to receive>107%
  - <25% (up to 35% acceptable) to receive>95%,
  - <50% (up to 60% acceptable) to receive >50% of the prescription dose
- Treated with 3-5 noncoplaner conformal fields

Interim Cosmetic and Toxicity Results From RAPID: A Randomized Trial of Accelerated Partial Breast Irradiation Using Three-Dimensional Conformal External Beam Radiation Therapy

July 8, 2013 as 10.1200/JCO.2013.50.5511



- >40 years,
- T < 3 cm,
- DCIS or invasive carcinoma,
- Node negative,
- Margin negative,
- No BRCA1 or 2

Large breasted patient :- 50 Gy/25#
Boost allowed :- 10 Gy/5# (21%)
Chemotherapy, if used, was completed before RT (15%)

Patient Characteristics

Table 1. Baseline Patient Characteristics

Characteristic	WBI (n = 1,065) No.	WBI (n = 1,065) %	APBI (n = 1,070) No.	APBI (n = 1,070) %
Age, years				
< 50	126	12	131	12
≥ 50	939	88	939	88
Cancer type				
Invasive breast cancer	873	81	879	82
DCIS alone	182	17	184	17
Unknown	10	2	7	1
Tumor size, cm				
< 1.5	655	62	653	61
≥ 1.5	410	38	417	39
ER*				
Positive	674	88	797	91
Negative	94	11	76	8
Not done/unknown	5	1	6	1
Tumor grade*				
I	349	40	373	42
II	355	41	348	40
III	157	18	145	17
Unknown/not available	12	1	13	1
Presence of LVI*	54	6	57	6
Chemotherapy*	137	16	130	15
Endocrine therapy*†	582	67	604	69

Marshfield Clinic

Table A1. Summary of Volume Definitions and Dosimetry Constraints for Planning APBI

Organ	Definition or Constraint
Ipsilateral BRV*	All tissues, excluding lung, from medial head of ipsilateral clavicle to 1.5 cm below inframammary fold from midline to mid-axillary line
Seroma	CT-evident postoperative bed, inclusive of any margin-marking clips but excluding 5 mm from skin and excluding pectoralis muscle or chest wall
APBI CTV	Seroma plus 1 cm, excluding chest wall and 5 mm from skin
APBI PTV	APBI CTV plus 1 cm
APBI dose to breast	
Constraint one	< 25% (acceptable up to 35% as minor deviation) of whole breast to receive 95% of prescribed dose
Constraint two	< 50% (acceptable up to 65% as minor deviation) of whole breast to receive 50% of prescribed dose
Ipsilateral lung	
Constraint one	< 10% of lung (minor deviation if up to 13%) to receive 30% of prescribed dose
Constraint two	< 20% of lung (minor deviation if up to 25%) to receive 10% of prescribed dose
Contralateral breast	< 3% of prescribed dose to any point
Heart	
Right-sided lesions	< 5% should receive 5% of prescribed dose
Left-sided lesions (excluding lower inner quadrant)	< 5% should receive 10% of prescribed dose
Left-sided lesions (lower inner quadrant)	< 5% should receive 15% of prescribed dose
Thyroid	< 3% of prescribed dose to any point

Abbreviations: APBI, accelerated partial-breast irradiation; BRV, breast volume; CT, computed tomography; CTV, clinical target volume; NSABP, National Surgical Breast and Bowel Project; PTV, planning target volume; RTOG, Radiation Therapy Oncology Group.

*Definition used for BRV is similar to that used in NSABP B-39/RTOG-0413 trial; definition for dose-evaluation volume is similar to definition of "PTV_eval" used in NSABP/RTOG trial.

Cosmetic Analysis

- By EORTC Cosmetic Rating System.
- At baseline, assessed by a trained nurse.
- Patient questionnaire
- Assessed by two panels of three radiation oncologists using the digital photographs on follow-up.

- The treated breast was compared with size and shape, location of the areola and nipple, appearance of the surgical scar, presence of telangiectasia, and global cosmetic score

Cosmetic Outcome

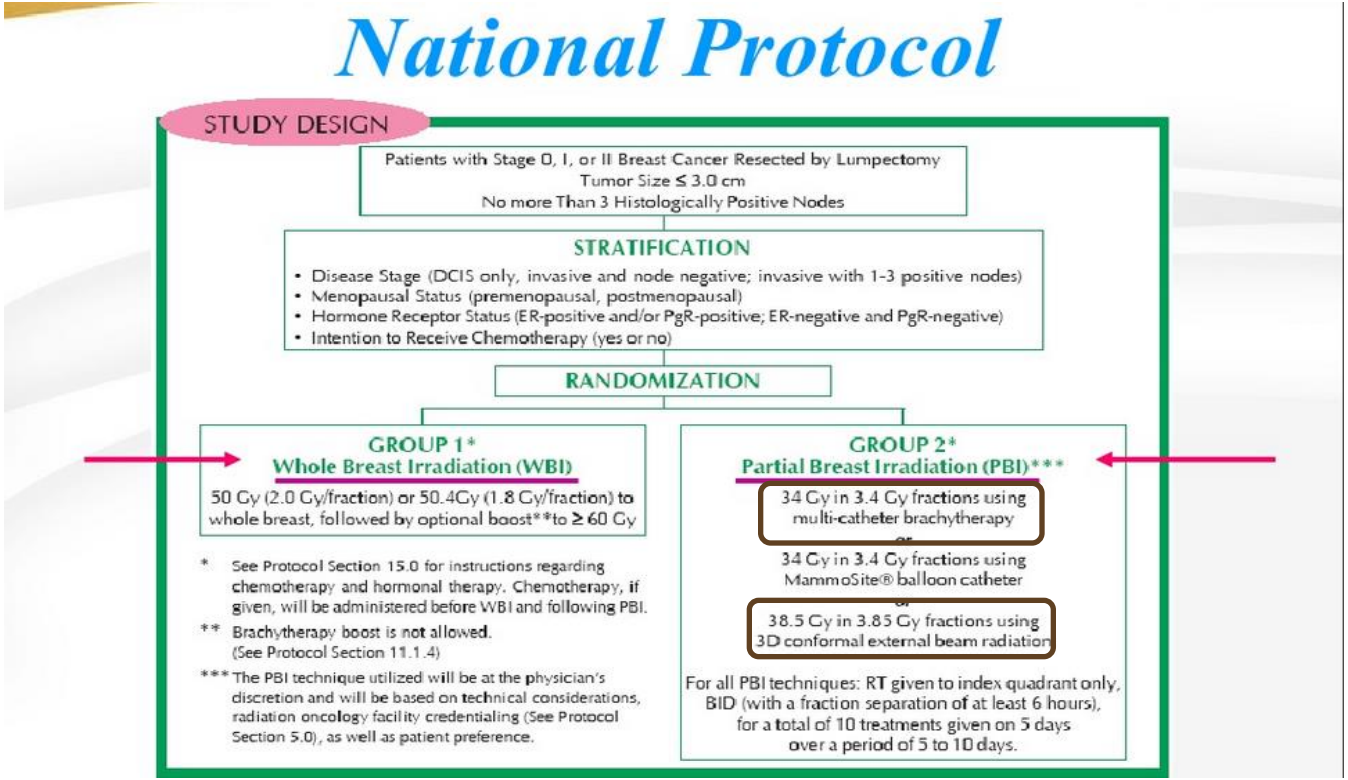
Table 2. Proportions of Patients With Adverse Cosmesis on Global Assessment* Reported by Nurses, Patients, and Physician Photograph Assessment Panels

Time	WBI		APBI		APBI – WBI Difference (%)	95% CI	*P*
	No.	%	No.	%			
Nurses							
Baseline (n = 2,055)	173 of 1,020	17.0	196 of 1,035	18.9	1.9	−1.4 to 5.3	.25
3 years (n = 1,108)	89 of 539	16.5	165 of 569	29.0	12.5	7.6 to 17.3	< .001
5 years (n = 335)	22 of 164	13.4	56 of 171	32.8	19.4	10.4 to 27.9	< .001
Patients							
Baseline (n = 2,055)	222 of 1,027	21.6	245 of 1,028	23.8	2.2	−1.4 to 5.8	.25
3 years (n = 1,100)	97 of 535	18.1	146 of 565	25.8	7.7	2.8 to 12.5	.0022
5 years (n = 328)	34 of 158	21.5	55 of 170	32.4	10.9	1.2 to 20.1	.034
Physician panels							
3 years (n = 766)	61 of 367	16.6	140 of 399	35.1	18.5	12.3 to 24.4	< .001

Median follow-up- 36 months

Marshfield Clinic

NSABP B-39 trial



Marshfield Clinic

Accelerated partial breast irradiation using intensity-modulated radiotherapy versus whole breast irradiation: 5-year survival analysis of a phase 3 randomised controlled trial

European Journal of Cancer (2015) 51, 451– 463

5y

patients 2005-2013

Conventional
WBI (260)
(50 Gy/ 25#/Boost 10 Gy)

APBI(260)
30 Gy/5#
Nonconsecutive days

5 year follow - up

- >40 years
- T < 2.5cm
- LVI allowed
- DCIS allowed
- ALN positive allowed

Marshfield Clinic

	ASTRO	GEC-ESTRO	ASTRO	GEC-ESTRO	ASTRO	GEC-ESTRO
	Suitable	Low-risk	Cautionary	Intermediate-risk	Unsuitable	High-risk
Age	≥60 years	>50 years	50–59 years	>40–50 years	<50 years	≤40 years
Tumor size	≤2 cm	≤3 cm	2.1–3.0 cm	≤3 cm	>3 cm	>3 cm
Histology	Invasive ductal carcinoma or other favorable subtypes	Invasive ductal, mucinous, tubular, medullary and colloid carcinoma	Invasive lobular carcinoma allowed	Invasive lobular carcinoma allowed	Any	Any
Grade	Any	Any	Any	Any	Any	Any
Pure DCIS	Not allowed	Not allowed	≤3 cm	Allowed	>3 cm	Any
EIC	Not allowed	Not allowed	≤3 cm	Not allowed	>3 cm	Allowed
Associated LCIS	Allowed	Allowed	Allowed	Allowed	Allowed	Allowed
Multicentricity	Unicentric only	Unicentric only	Unicentric only	Unicentric only	Multicentric	Multicentric
Multifocality	Clinically unifocal ≤2 cm	Unifocal	Clinically unifocal 2.1–3.0 cm	Multifocal (limited within 2 cm of the index lesion)	Clinically multifocal	Multifocal (>2 cm of the index lesion)
Lymph-vascular invasion	Not allowed	Not allowed	Limited/focal	Not allowed	Extensive	Allowed
Estrogen receptor	Positive	Any	Negative	Any	Any	Any
Surgical margins	≥2 mm	≥2 mm	Close (<2 mm)	Close (<2 mm)	Positive	Positive
Lymph node status	pN0 (i−,i+)	pN0	pN0 (i−,i+)	pN1mi, pN1a	≥pN1	pNx, ≥pN2a
BRCA1/2 mutation	Not present	Not defined	Not present	Not defined	Present	Not defined
Neoadjuvant therapy	Not allowed	Not allowed	Not allowed	Not allowed	If used	If used

Marshfield Clinic

ASTRO Recommendations

Low risk - APBI outside the context of a clinical trial is an acceptable treatment option

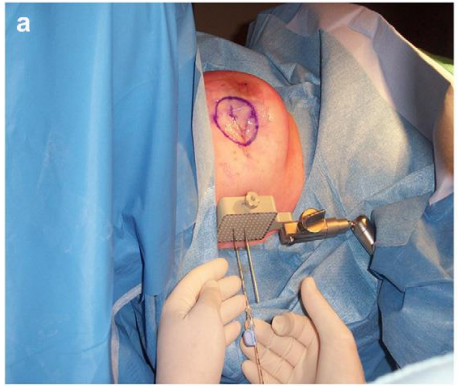
High-risk group- APBI is considered C/I

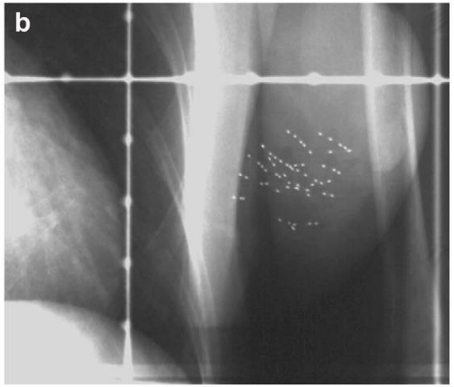
Intermediate risk group- APBI is considered acceptable only in the context of prospective clinical trials.

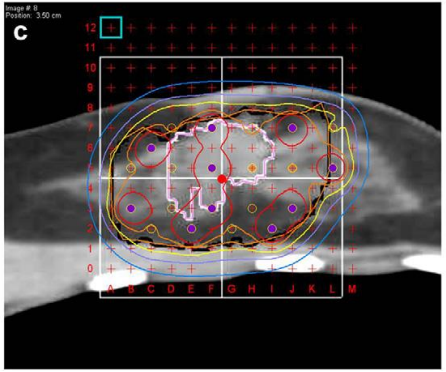
Novel methods

Permanent breast seed implant

- Percutaneous insertion of radioactive seeds (palladium-103) under US guidance
- Use of LDR sources has the potential for improving the therapeutic ratio
- A preplan is generated with optimal seed position and spacing to deliver the prescribed dose of 90 Gy to cover the lumpectomy cavity with a 1.5-cm margin.
- Using a grid template 103Pd seeds are placed according to the preplan needle and seed distribution.


a


b


c

Current RTOG / NSABP Trial

- Phase III randomized comparison of whole breast vs. short-course partial breast XRT
- Stage 0, I, or II with T<3cm
- No more than 3 histologically positive nodes
- Post-surgical CT evaluations of lumpectomy cavity
- Defined ratios of partial-breast to whole-breast volumes
- Either interstitial catheters, Mammo Site, or 3D conformal (NOT IMRT) radiotherapy
- Twice daily for 10 fractions over 5-7 day

No data available yet

CONCLUSIONS

- In about 5-8 years, the ongoing studies will hopefully answer the questions related to patient selection, long-term outcome, and toxicity of the different techniques.

- A modest reduction in initial treatment efficacy cannot be justified in patients with early breast cancer, who have an excellent prognosis with standard BCT including WBI.

- For now, patients should be carefully selected for APBI and closely followed with accurate documentation of outcomes

THANK YOU