Challenges and pitfalls in setting up a multicatheter breast brachytherapy service

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Conflict of Interest

- I have no conflict of interest

Issues to be address

- Is there enough evidence to start a breast multicatheter programme
- Multi disciplinary team “buy in”
- Patient acceptance
- Training of staff
- Equipment
- Technique (to be covered in the hands on session)

Is there enough evidence to start a multicatheter breast programme

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Phase III randomised trial

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

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Trial Design

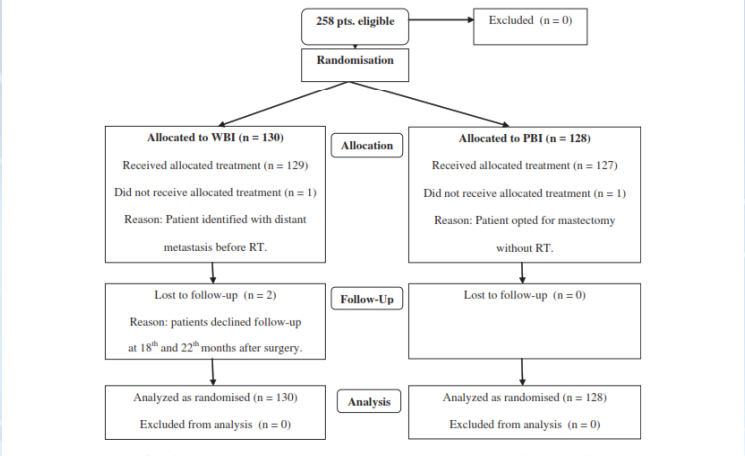


Fig. 1. CONSORT trial flow diagram. *Abbreviations:* WBI – whole breast irradiation; PBI – partial breast irradiation; RT –radiotherapy.

Table 1
Patient and tumor characteristics by treatment arms.

Characteristic	PBI (n = 128)	WBI (n = 130)	p-Value
Mean age (years)	59	58	0.31[b]
Range	30–84	31–80	
Age groups (years)			0.23
⩽40	3 (2.4)	6 (4.6)	
41–50	26 (20.3)	26 (20.0)	
51–60	41 (32.0)	50 (38.5)	
>60	58 (45.3)	48 (36.9)	
Premenopausal	27 (21.1)	28 (21.5)	0.93
Pathological tumor size (mm)			0.14
⩽5	8 (6.2)	3 (2.3)	
>5 but ⩽10	39 (30.5)	35 (26.9)	0.13[b]
>10 but ⩽20	81 (63.3)	92 (70.8)	
Median	13	13	
Pathological nodal status			0.25
pN0	121 (94.5)	123 (94.6)	
pN1mi	3 (2.3)	6 (4.6)	
Not known (no axillary surgery)	4 (3.2)	1 (0.8)	
Surgical margins			0.78
Close (<2 mm)	0 (0)	1 (0.8)	
Clear (⩾2 mm)	123 (96.1)	123 (94.6)	
Clear (NSABP)[a]	5 (3.9)	6 (4.6)	
Histologic type			0.52
Ductal	103 (80.5)	108 (83.1)	
All others	25 (19.5)	22 (16.9)	
Tumor grade			0.03
1	81 (63.3)	65 (50)	
2	47 (36.7)	65 (50)	
ER status			0.42
Positive	116 (90.6)	113 (86.9)	
Negative	10 (7.8)	16 (12.3)	
Unknown	2 (1.6)	1 (0.8)	

Abbreviations: PBI – partial breast irradiation; WBI – whole breast irradiation; ER – estrogen receptor. Data are n (%).
[a] National Surgical Adjuvant Breast and Bowel Project criteria, no tumor on ink.
[b] Mann–Whitney two-sample test. All other variables were tested with the chi-square test.

Majority of patients were highly selected

Above 40 yo
Less than 2 cm
Node –ve
Clear margins >2mm
Good histo subtype

Local Relapse Rate

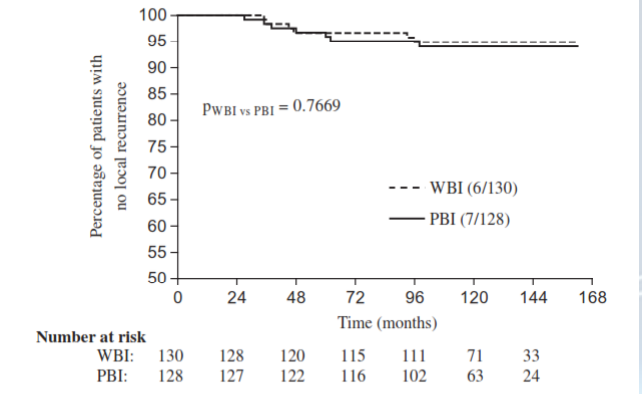


Fig. 2. Time to local recurrence by Kaplan–Meier estimates. *Abbreviations:* WBI – whole breast irradiation; PBI – partial breast irradiation.

There is no statistical difference for local recurrence between the APBI and EBRT @ 10 yrs

Cosmetic outcome

APBI EBRT

Table 4
Cosmetic outcome.

Harvard cosmetic score	PBI – HDR BT ($n = 85$)[a]	PBI – EB ($n = 40$)[a]	WBI – photons ($n = 93$)[a]	WBI – cobalt ($n = 23$)[a]
Excellent	29 (34.1)	7 (17.5)	16 (17.2)	3 (13.1)
Good	43 (50.6)	22 (55.0)	46 (49.5)	8 (34.8)
Fair	11 (12.9)	11 (27.5)	22 (23.6)	11 (47.8)
Poor	2 (2.4)	0 (0)	9 (9.7)	1 (4.3)

Abbreviations: PBI – partial breast irradiation; HDR BT – high-dose-rate brachytherapy; EB – electron beam; WBI – whole breast irradiation. Data are *n* (%).
[a] *n* = patient number with data available on cosmetic outcome.

- APBI cosmesis was better than EBRT
- APBI HDR multicatheter APBI cosmesis was the best

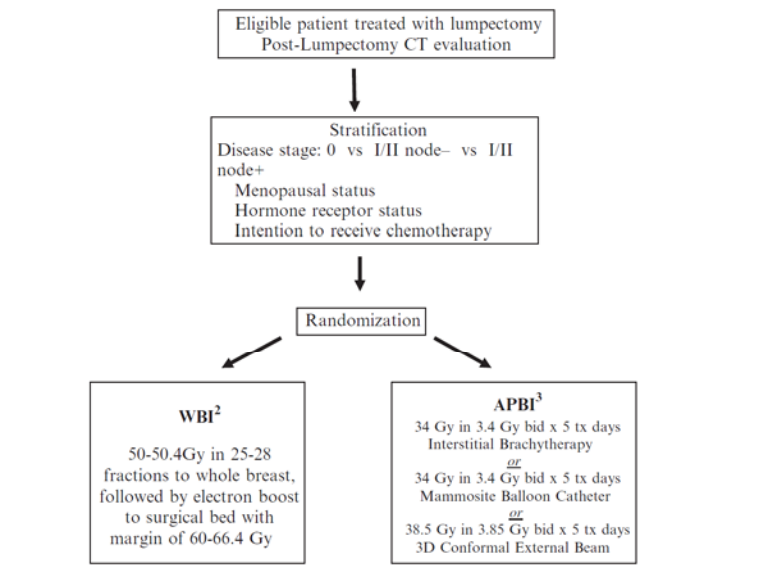
Ongoing Clinical Trials for multicatheter Breast Brachytherapy-Results Pending

- RTOG 0413
- GEC ESTRO TRIAL

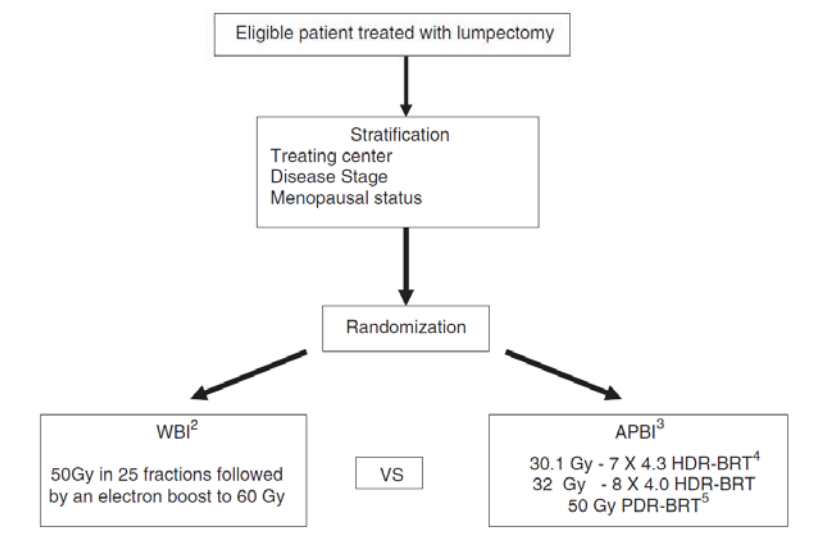
Patient Eligibility for the RTOG AND GEC ESTRO Trials

	NSABP B39/RTOG 0413[a] **	GEC-ESTRO[b] Multicenter Phase III Trial
Patient age	All ages	≥40 years old
Tumor size	≤3 cm	≤3 cm
Histology	All invasive histologies Ductal carcinoma in situ	All invasive histologies Ductal carcinoma in situ (Van Nuys prognostic index[c] < 8 only)
Margin status	Negative (no tumor extending to inked margin)	Nonlobular invasive histologies > 2 mm Invasive lobular carcinoma > 5 mm Ductal carcinoma in situ > 5 mm
Node status	pN0–pN1 0–3 Positive nodes Extracapsular extension negative	pN0–pN1mic negative or microscopic involvement only

RTOG 0413 Schema



GEC ESTRO Schema



Who is the "suitable" patient

- Consensus guidelines being published by various societies/groups
  - ASTRO
  - ESTRO
  - American Brachytherapy Society
- Mainly divided into 3 groups
  - Suitable
  - Cautionary
  - Unsuitable
- Guidelines are guidelines and are subjected to review once new clinical data emerges

Eligible Patients for APBI

Criteria	ABS	ESTRO*	ASTRO*
Age	≥ 50 years old	> 40 years old	≥ 50 years old
Size	≤ 3 cm	≤ 3 cm	≤ 3 cm
Histology	all invasive subtypes and DCIS*	all invasive subtypes and DCIS*	all invasive subtypes and DCIS*
Estrogen receptor	positive/negative	positive/negative	positive/negative
Surgical margins	negative	negative/close (< 2 mm)	negative/close (< 2 mm)
Lymphovascular space invasion	negative	negative	negative/focal
Nodal status	negative	< 4 lymph nodes involved	negative

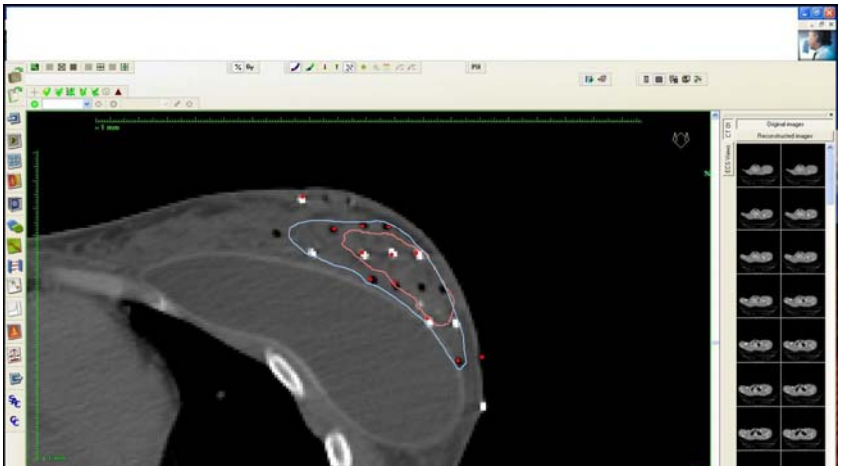
*Ductal carcinoma in-situ; *Excluding unsuitable category

In our institution, both the suitable and cautionary groups are eligible for APBI

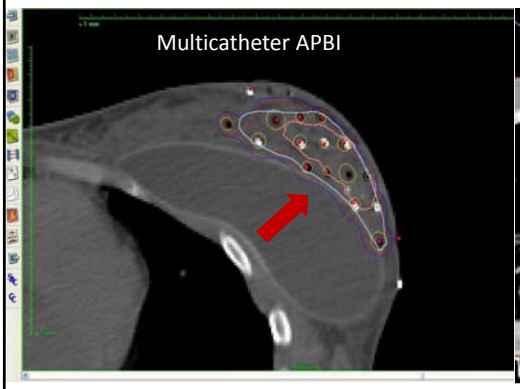
Other "Suitablility" Considerations

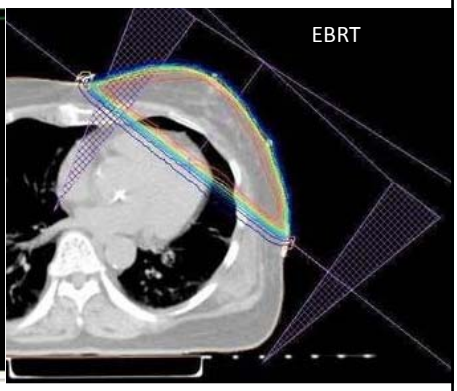
- Also, breast size is important
  - much more difficult to do in small cup size breast
- Location of the tumour bed
  - extreme medial or lateral lesions tend to be more challenging due to smaller breast tissue volume
- Augmented Breast Patients
  - multicatheter may be used in Augmented breast patients

Special Scenario
Augmented Breast with Implants



- Interstitial Multicatheter is the most versatile technique – most suitable for Augmented Breast with Silicon Implants
- Done under imaged guidance, it is difficult to puncture the implant





- Minimal dose to the implants, hence less contracture and fibrosis of the implants compared to whole breast external beam RT
- Very conformal to the PTV, hence minimal dose to surrounding breast tissues leading to less normal breast parenchymal toxicity

➡ Cannot achieve such dose distribution with external beam RT

Multi disciplinary "buy in"

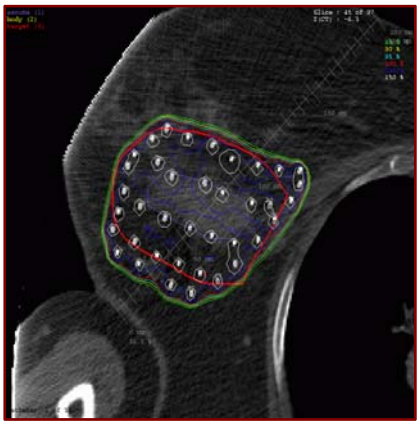
- There must be "buy in" from the multidisciplinary team for the programme to be successful
- Convince breast surgeons
- Convince medical oncologists
- Good breast coordinator

Pros & Cons compared to EBRT

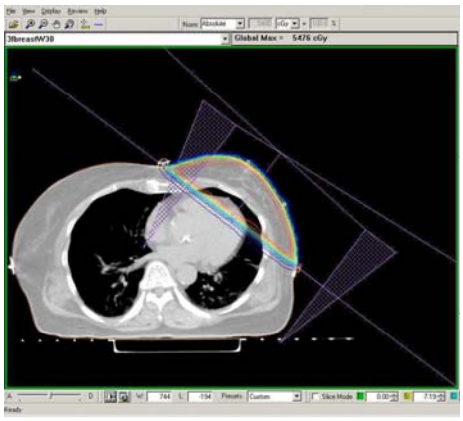
BRACHYTHERAPY COMPARED TO EXTERNAL BEAM RADIOTHERAPY

Features	HDR brachytherapy	External Beam therapy
Treatment area	Tumour site with margins only	Entire breast
Number of treatments	10 treatments over 1 week	25 – 30 treatments over 5-6 weeks
Convenience	More convenient for those with busy work schedules or long commutes	Great time commitment required. May be disruptive to work schedules
Radiation to adjacent organs	Less radiation to lung, heart, rib and lymphatics	Acceptable radiation to lung, heart, ribs and lymphatics
Skin care	Requires bandaging and care of catheter sites	Daily application of creams during radiotherapy and about 3 months after radiotherapy
Cure rates	Comparable long term results to external beam radiotherapy	Currently the gold standard for breast treatment
Appearance	Favourable cosmesis, minimal scarring	Acceptable and favourable in most instances
Invasive	Yes, requires insertion of catheters into the breast	No. External X-rays only

Dose distribution for APBI and EBRT



APBI

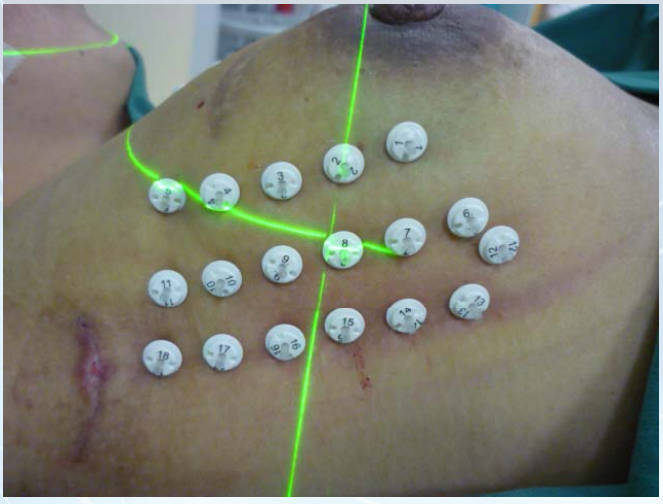


Conventional EBRT

Patient acceptance

- Patients generally are keen for APBI due to
  - Shorter overall treatment time
  - Better cosmesis
  - Better toxicity
- However, they are concern about the invasiveness and the on-treatment appearance

Picture of the final breast implant



Picture of the final breast implant

Treatment

Patient appearance during treatment

By placing the catheters below the bra line, catheters are not seen when the bra is worn, giving excellent cosmesis and patient satisfaction

Patient Cosmesis

@6 months

@5 years

Training of staff

- Operator dependent procedure
- Steep learning curve for multicathter interstitial brachytherapy
- Our center experience showed that a minimal of 6 assisted multicatheter implant was required to achieve a minimal level of competency

Training of staff

- Various training programmes available
  - ABS breast school
  - ESTRO breast course
  - Euro Asia breast school
- Target audience
  - Physicians
  - Medical Physicist
  - Radiation therapist
  - Nurse clinician (after wound care)

Equipment needed for multicatheter insertion

- In addition to the HDR afterloader and planning system, there are additional specific equipment needed for multicatheter APBI

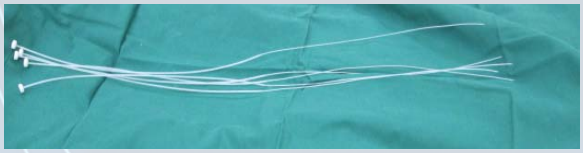
Kuske Template

- Advantages:

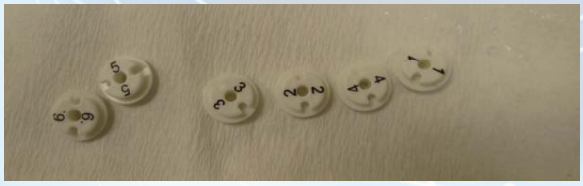
1. Breast firmly secured
2. Suitable for all sizes breast
3. Evenly spaced
4. Better dose homogeneity

Insertion Needles

Comfort Catheter System



Plastic Catheters



Buttons – numbered from 1 to 18

Threading and securing the catheters

The plastic catheters are threaded through the breast via the metal sheath.

At the other end of the catheter, the number buttons are inserted and secured on the breast surface

Flange Thermal Device

Conclusions

- To commence a successful breast multicatheter brachytherapy programme, obtaining “buy in” from members of the multidisciplinary team is essential
- Careful patient selection and staff training are important to obtain good clinical outcomes
- Patient education on the clinical outcomes and cosmesis is critical for patient acceptance

Thank you