



มิถุนายน 2548



# Intra-Operative RT

## for Early Stage Breast Cancer

01 March 2024





- **BCT** - *better breast satisfaction & quality of life*
- **Currently ALL Patients with EARLY Breast Cancer (EBC)** - *are offered BCT*
- **BCT for 'Large Operable Breast Cancer' & 'Locally Advanced Breast Cancer' (LABC)** - *seems feasible following Neoadjuvant CMT in patients who wish to conserve their breasts*



- **Typically 5 days** (fractions) **per week** × **5-6 weeks**
  - *WBRT + Boost*
- **Adjuvant doses** 45 - 60 Gy in 1.8 -2 Gy fractions
  - *smaller fraction size : reduced incidence & severity of AEs*



- **Postoperative RT**
  - *forms part of BCT*
  - *consumes enormous resources & time  
~1/3 of RT workloads*
  - *discourage women from receiving the  
benefits of BCT to choosing mastectomy  
instead*





# Radiotherapy



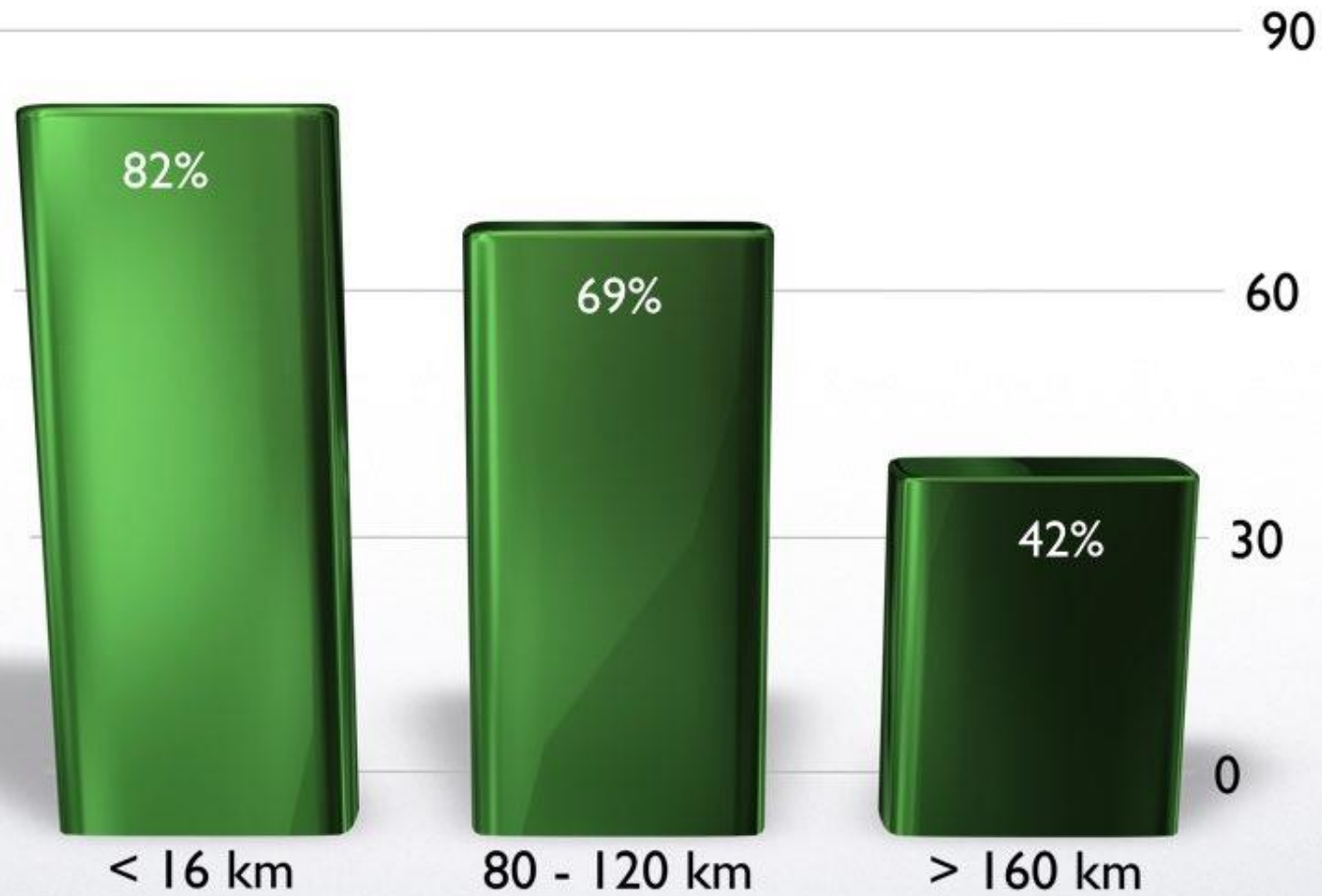
**Linear Accelerator**  
For Conventional Irradiation



- **Barriers** deterring the patient's decision from BCT
  - *Time i.e. inconvenience*
  - *Geographical*
- Doctor's concerns of **Benefits vs Risks**



# Distance-related Decision

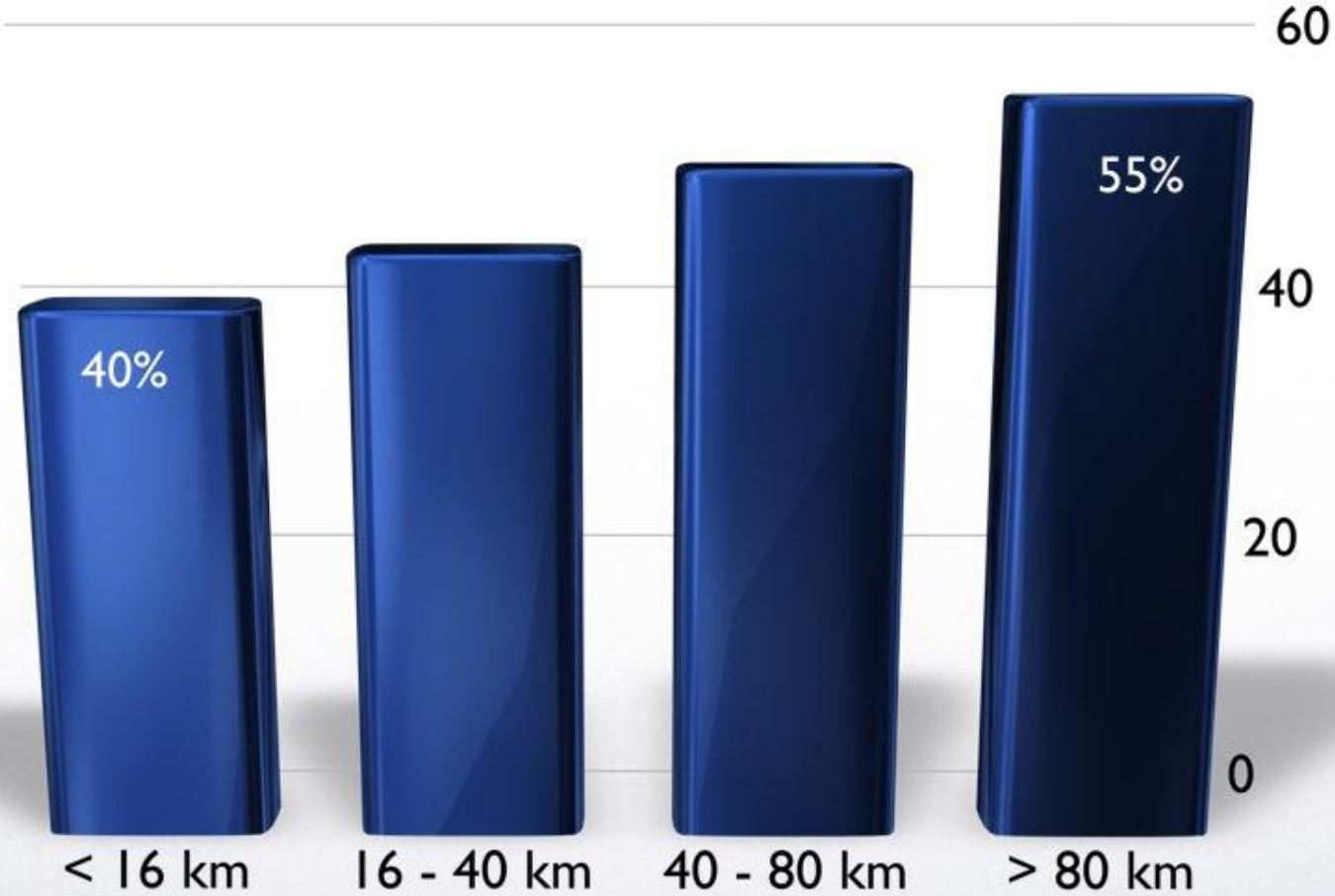


*Proportion of patient receiving RT after BCT*





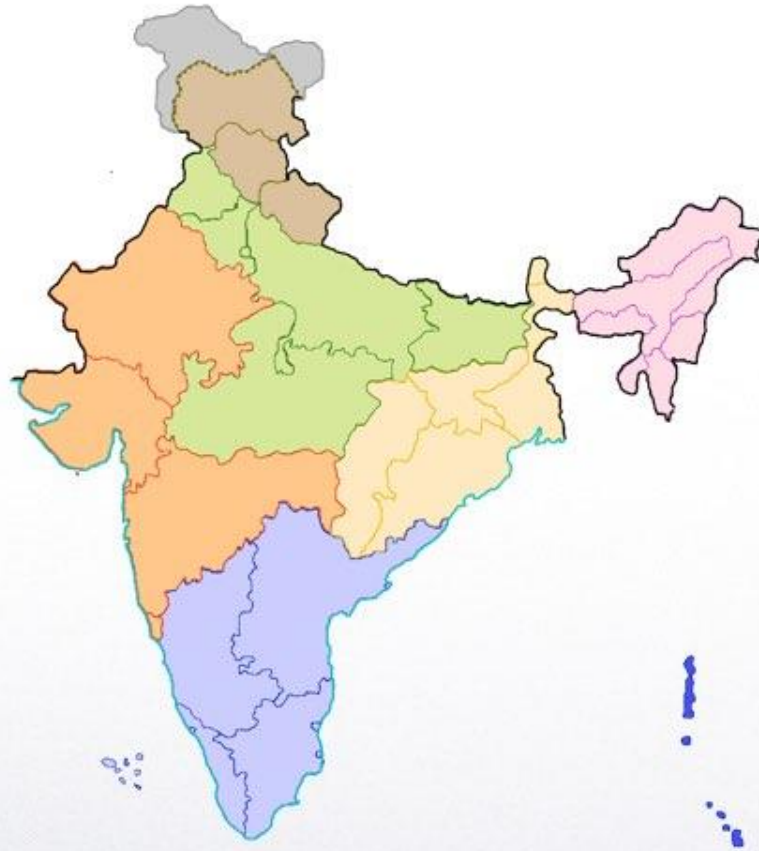
# Mastectomy Rate vs Patient Distance



*Impact of Patient Distance to RT on Mastectomy Use in Early Stage Breast Cancer*



# Geographical Barriers



**India, South Asia**  
3,287,263 sq.km.

Thailand 513,120 sq.km.



**Texas, USA**  
695,662 sq.km.

UK 242,495 sq.km.





# Geographical Barriers



## 3-D Mammography

For Remote Community



Mobile Breast Imaging Unit,  
Texas, USA

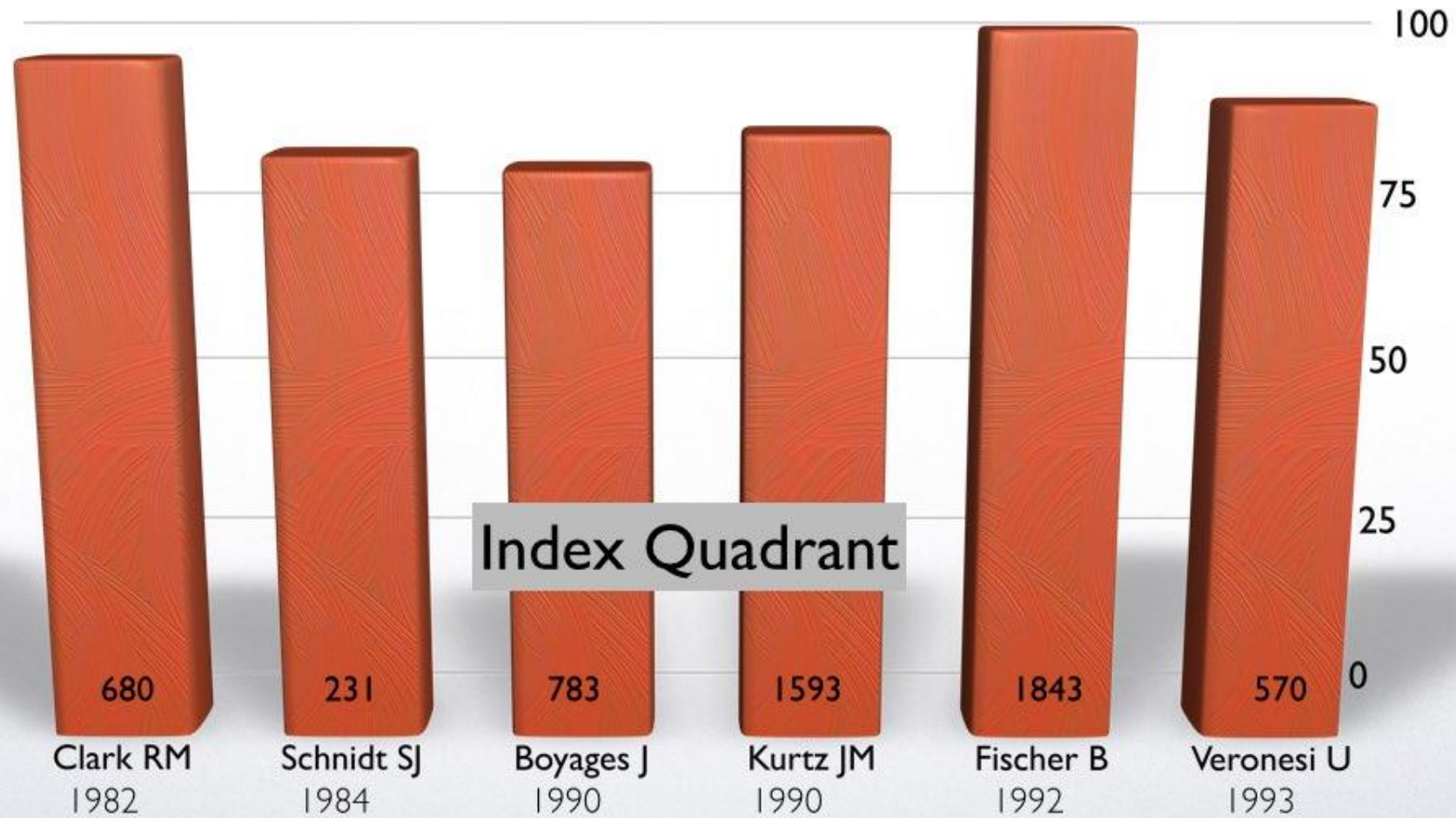


# Intra-Operative RT





# Most Local Recurrence after BCT





- Receiving RT **Directly to the Tumour Site**
  - *SIMILAR Dose\** of radiation in a Single Session
  - **maximising effect** - Minimising Recurrence
- **Minimising Time** spent (*back and forth to the Hospital*)
- **Reduction of Side Effects**





# IORT

## Radiation Devices



- **Electron IORT\*** (*electron beams 3-12 MeV*)
- **X-ray IORT** (*orthovoltage 250-300 kV*)
- **HDR-IORT** (*high-dose-rate brachytherapy*)
- **Low-energy IORT\*** (*50 kV*)



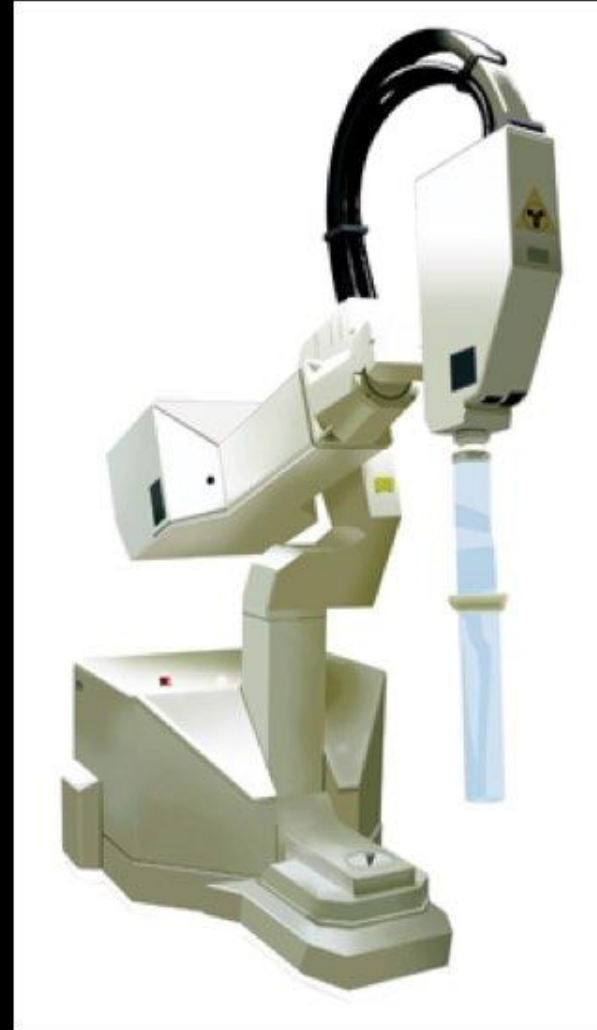
## Single-Fraction & Boost IORT Studies for Breast Cancer

| Device                                    | Beam                  | Breast Single-Fraction Delivery Time | Disease Sites   | Applicators              | Operating Room Requirements   |
|---|-----------------------|--------------------------------------|---|--------------------------|-------------------------------|
| <b>Mobetron</b><br>(IntraOp Medical, Inc) | 6-12 MeV;<br>electron | 2 min                                | Breast, skin, gyn,<br>rectal, pancreas,<br>sarcoma, pediatric | 3- to 10-cm<br>Reusable  | Door opening;<br>115 x 201 cm |
| <b>Novac-7</b><br>(New Radiant Tech)      | 4-10 MeV;<br>electron | 3-5 min                              | Breast, skin, gyn,<br>rectal, pancreas,<br>sarcoma, pediatric | 3- to 10-cm<br>Reusable  | Standard<br>dimensions        |
| <b>INTRABEAM</b><br>(Carl Zeiss Meditec)  | 50 kV;<br>photon      | 20 min                               | Breast, skin, gyn, brain                                      | 1.5- to 5-cm<br>Reusable | Standard<br>dimensions        |
| <b>Milan</b>                              | ≤ 5.0cm               | 12 Gy                                | 9 mo  | NR                       | NR                            |

# Mobile Electron IORT - /



Mobetron USA



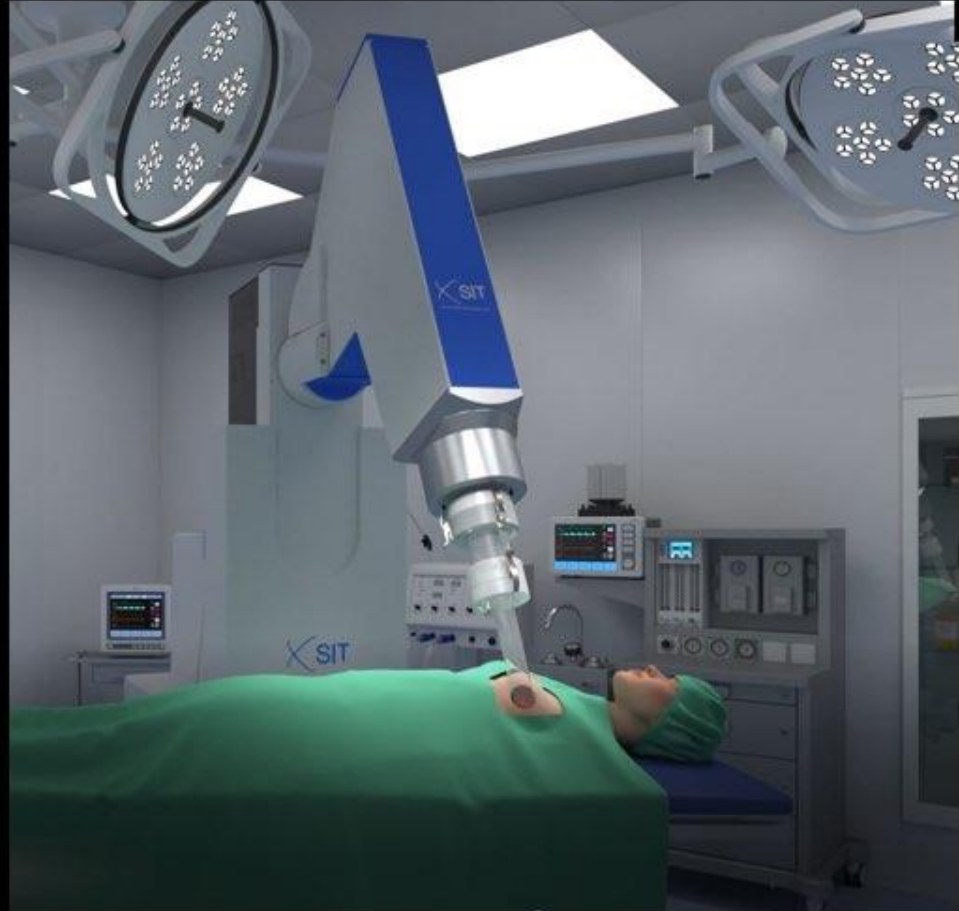
Novac-7 Italy



# Mobile Electron IORT -2

LIAC HWL Italy

*IOeRT*



# Low-energy IORT (50 kV)



Intrabeam Germany



- **Diameters:**  $1.5 - 5.0$  cm
- *in steps of 0.5 cm*

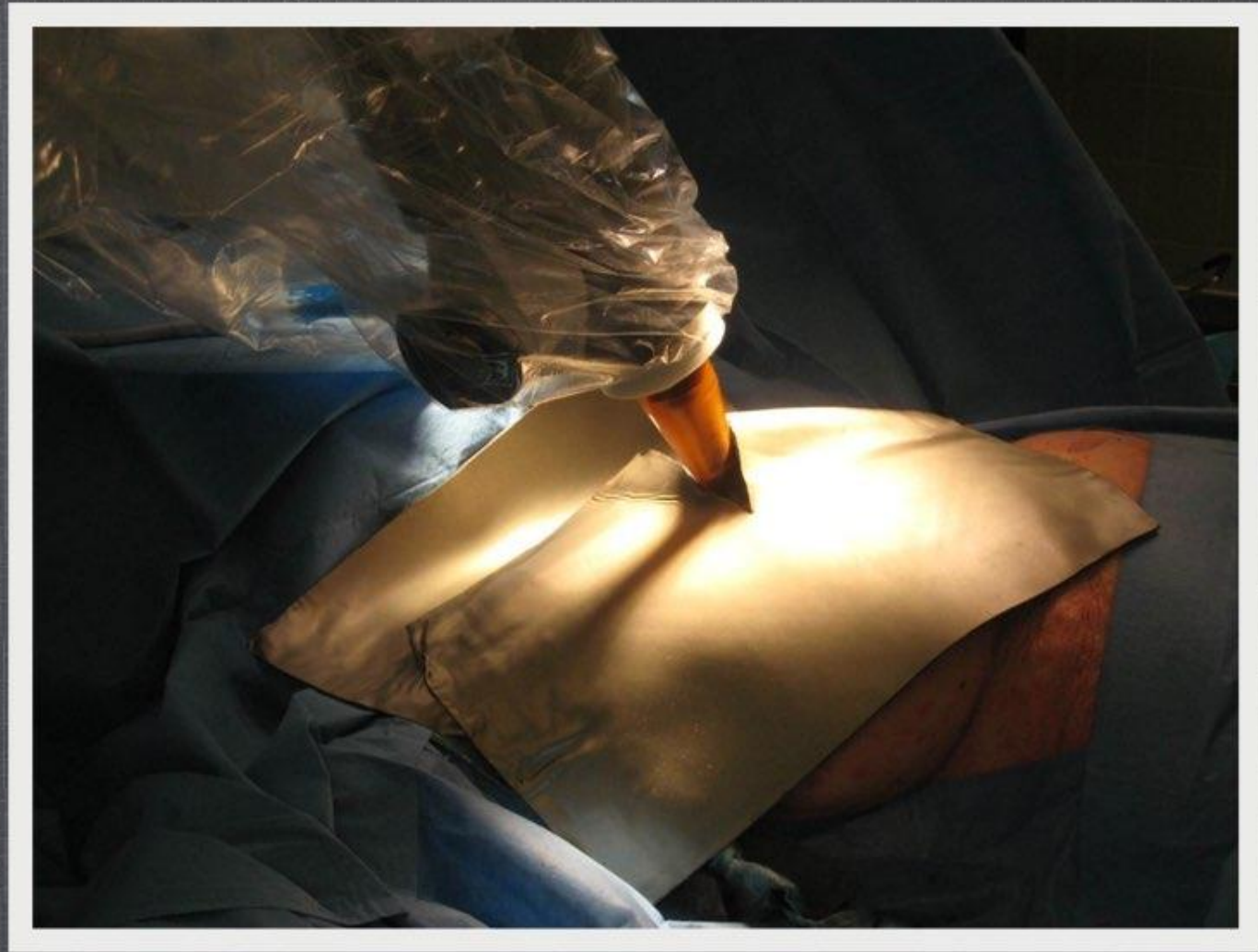


# Low-energy IORT (50 kV)

Elekta Xoft Axxent eBx Sweden



Brain - Breast - Skin - Gyne



IORT *at* KCMH

*First in SEA Since 2009*

# LONG TERM SURVIVAL & LOCAL CONTROL OUTCOMES RCT

*Jayant S Vidaya et al from 32 centres in 10 countries*

SINGLE DOSE (March 2000 - June 2012)

2298 women (1140 IORT vs 1158 EBRT)

Aged  $\geq$  **45 years** / **IDC** size **up to 3.5 cm** + **cN0-N1**

**Outcomes:** Non-inferiority with margin of 2.5% absolute difference (1.16%) between **5-year Local Recurrent Rates & Long term Survival Outcomes**

**Conclusion:** An effective alternative to EBRT





1. Excision of breast lump



4. Low-energy radiation 20-30 min

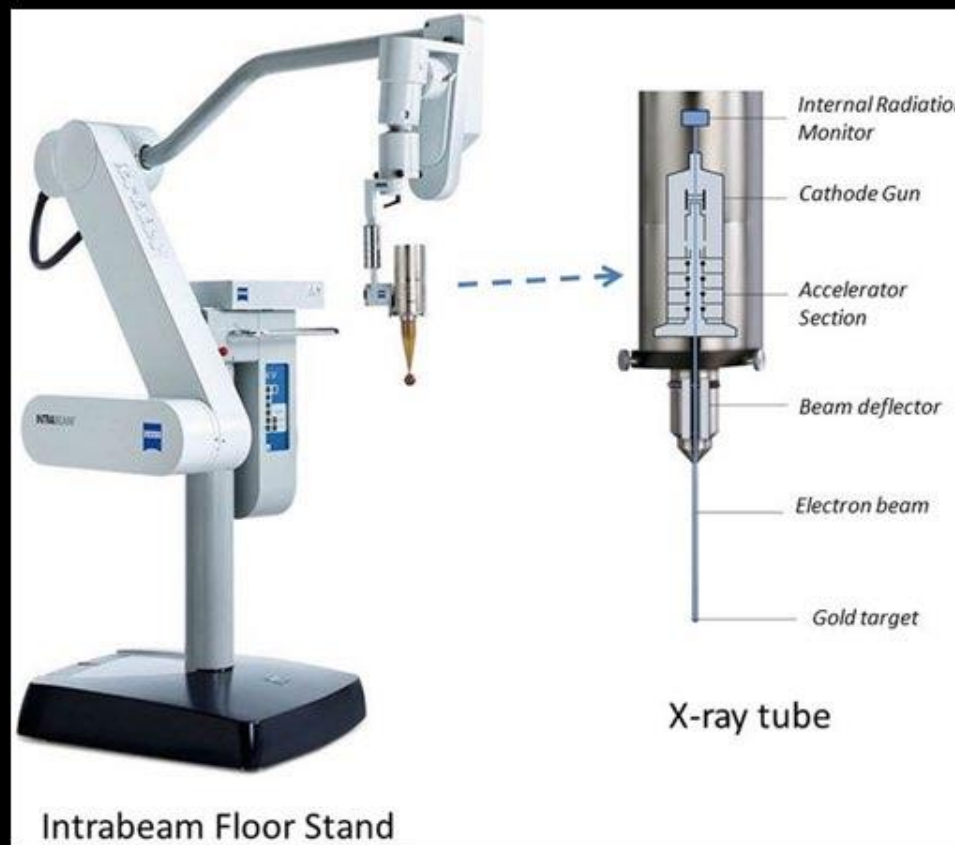
Four Steps  
for IORT  
(Intrabeam)



2. Placement of applicator in tumour bed

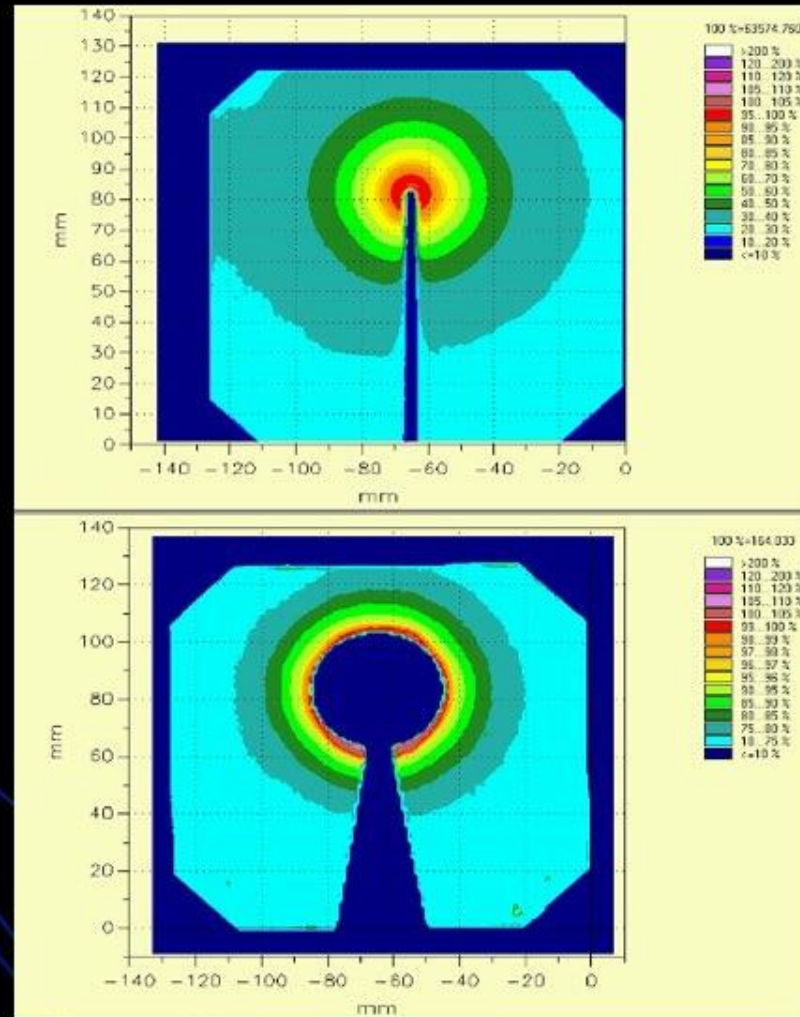


3. Protection of skin



- **Prescription Dose** = 20 Gy at the surface of applicator

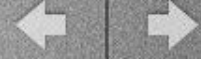
# Radiation Dose Distribution



Bare probe

With 4-cm  
*spherical applicator*





# Postoperative Follow-up



7 weeks  
postoperative





16 weeks  
postoperative



# RESULTS OF IORT GIVEN AS A BOOST AFTER BCS

*Kraiwut Onthong et al*

81 women aged 45 years and older

(Dec 2009 - Mar 2017) Median Follow-up: 43 months

**Outcomes:** 1. **3-year Local Recurrent Rates** 1.2%

2. **OSR** 89.8%

3. **Toxicity** Only Grade 1-2

4. **Cosmetic Outcome** Excellent-good Cosmesis

**Conclusion:** An alternative to EBRT boost



# Intra-Operative RT

## Progress Report

*260 Cases*

*(Since December 2009 = 14 years experience)*

# NUMBER OF CASES (260)

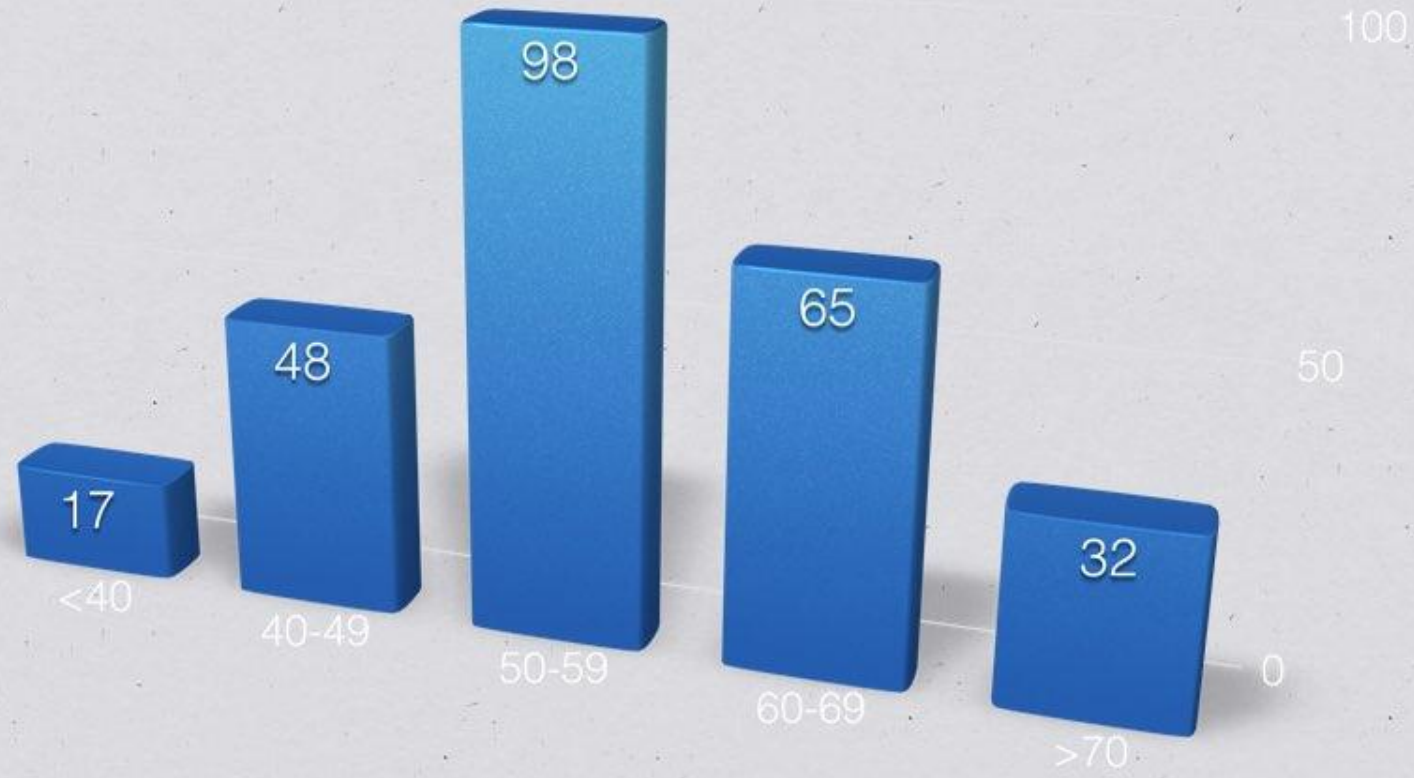
2009 - 2024



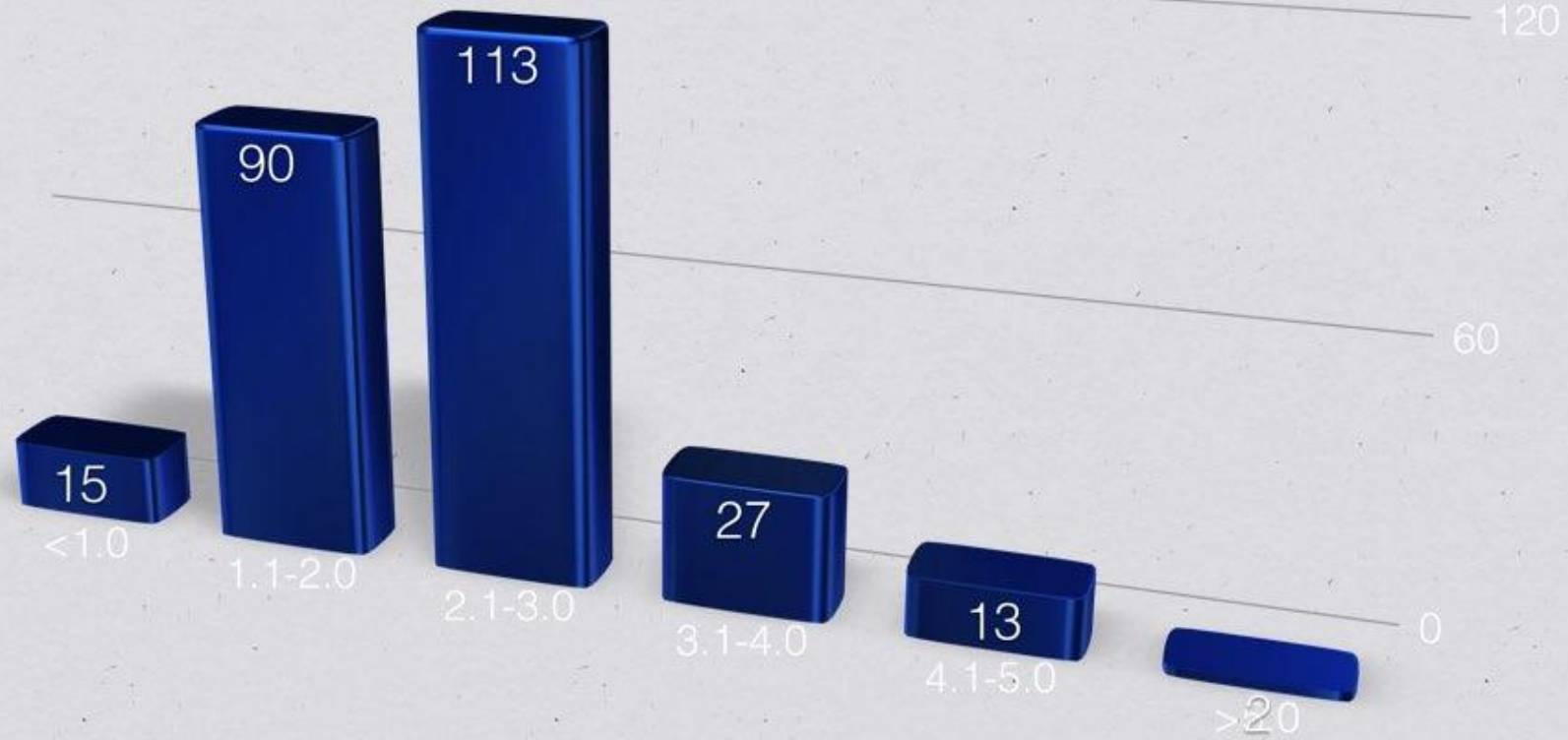


# AGE

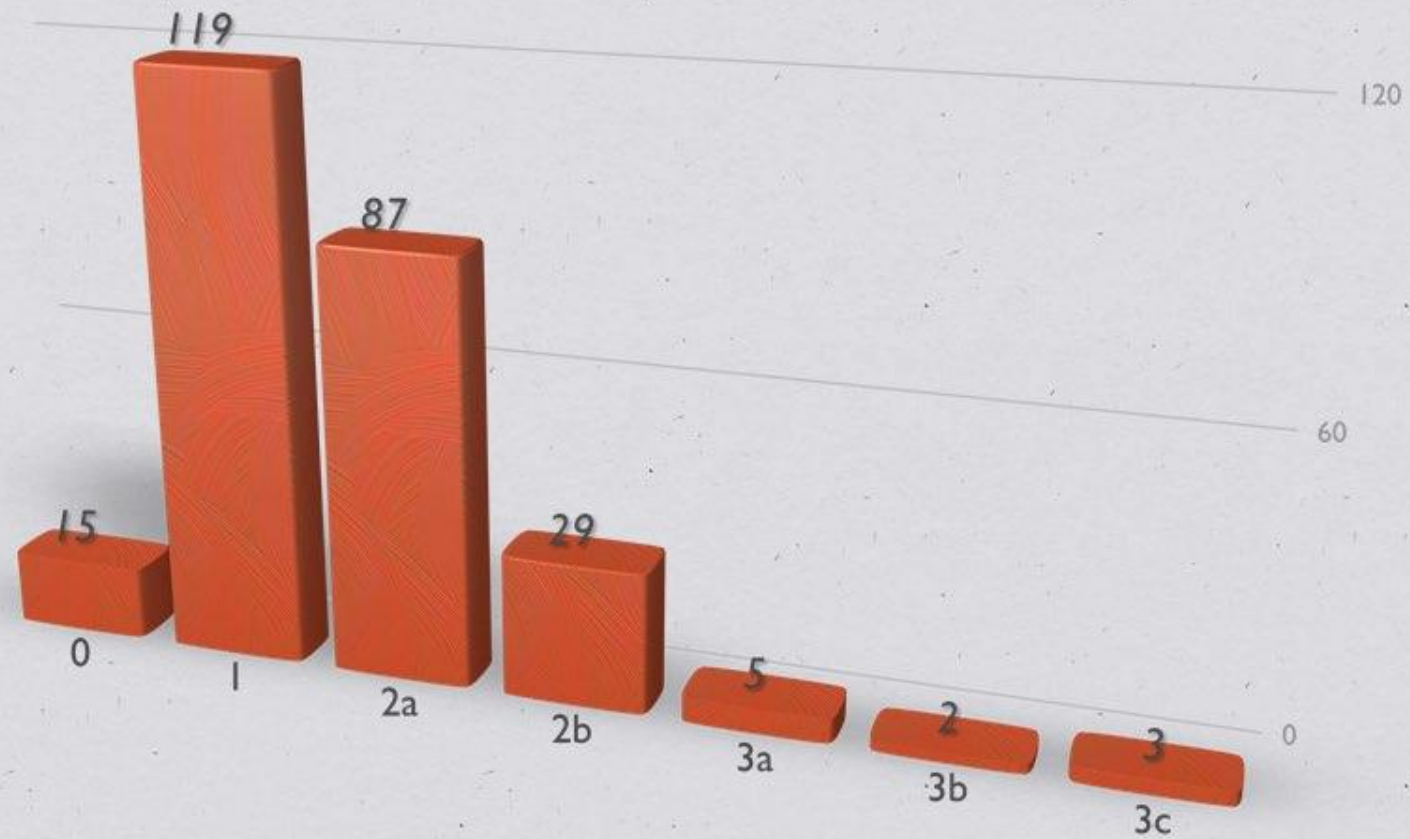
(Average 59.6 years)



# TUMOUR SIZE (CM)



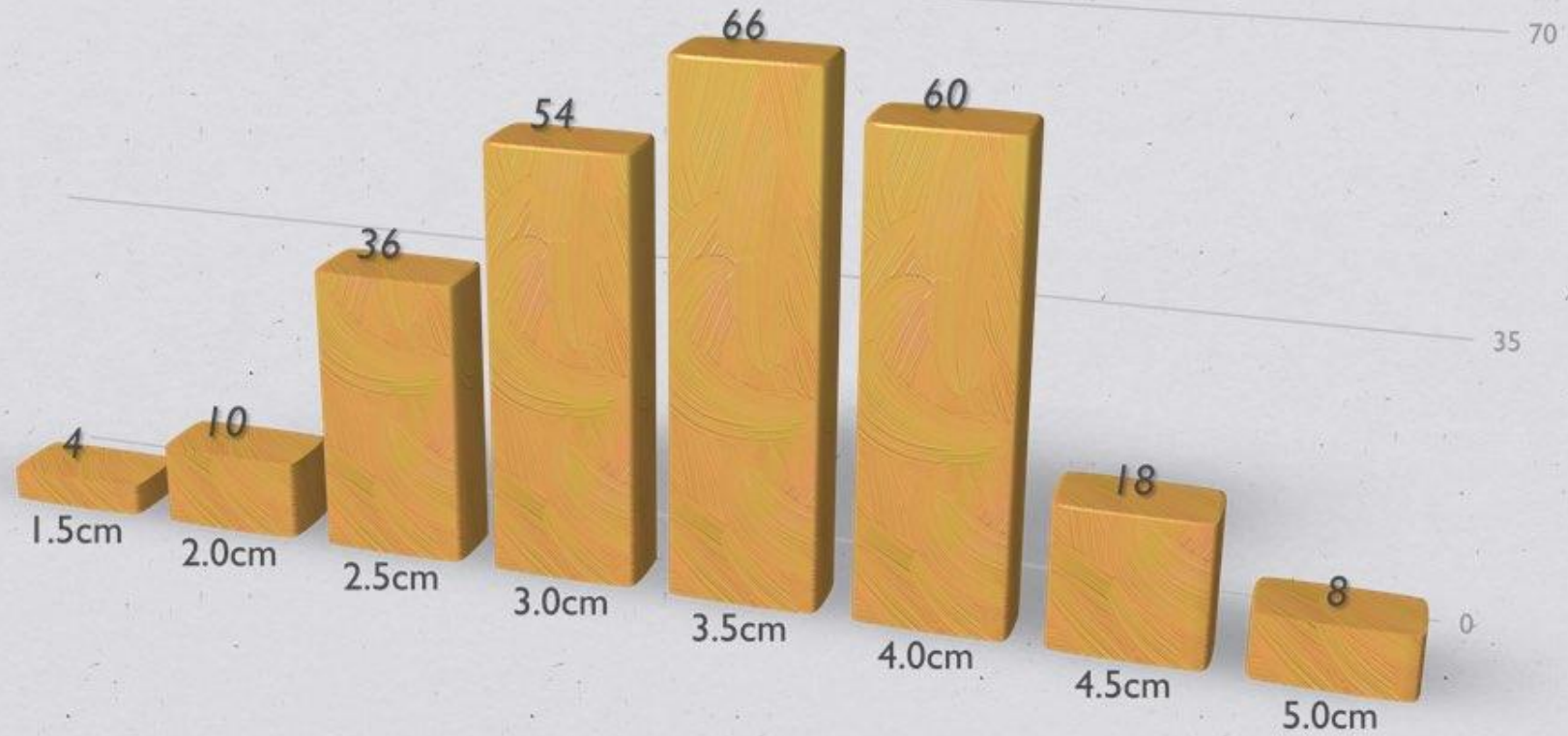
# STAGING





# APPLICATOR SIZE (CM)

Size 1.5cm - 5.0cm (median 3.5cm)



Application time : 18:34 - 40:16\*\* min

IORT KCMH

# PATHOLOGY OF IORT PATIENT

(14+ YEARS)

- **Invasive Ductal Ca** ~ 75 %
- **DCIS** ~ 10 %
- **Others** ~ 15 % *eg. Micropapillary, Mucinous, Invasive Lobular & Mammary ductal cancer*

# IORT AT KCMH

## COMPLICATIONS

|               |   |    |             |
|---------------|---|----|-------------|
| Skin Necrosis | : | 2  | (grade 4)   |
| Inflammation  | : | 16 | (grade 1-2) |
| Seroma*       | : | 30 | (grade 1-2) |
| Hematoma      | : | 8  | (grade 1-2) |
| Mastitis      | : | 2  | (grade 1-2) |
| Edema         | : | 40 | (grade 1-2) |
| Rash          | : | 8  | (grade 1-2) |
| Pain:         | : | 8  | (grade 1-2) |



# IORT AT KCMH

(14+ YEARS)

## ■ Complications

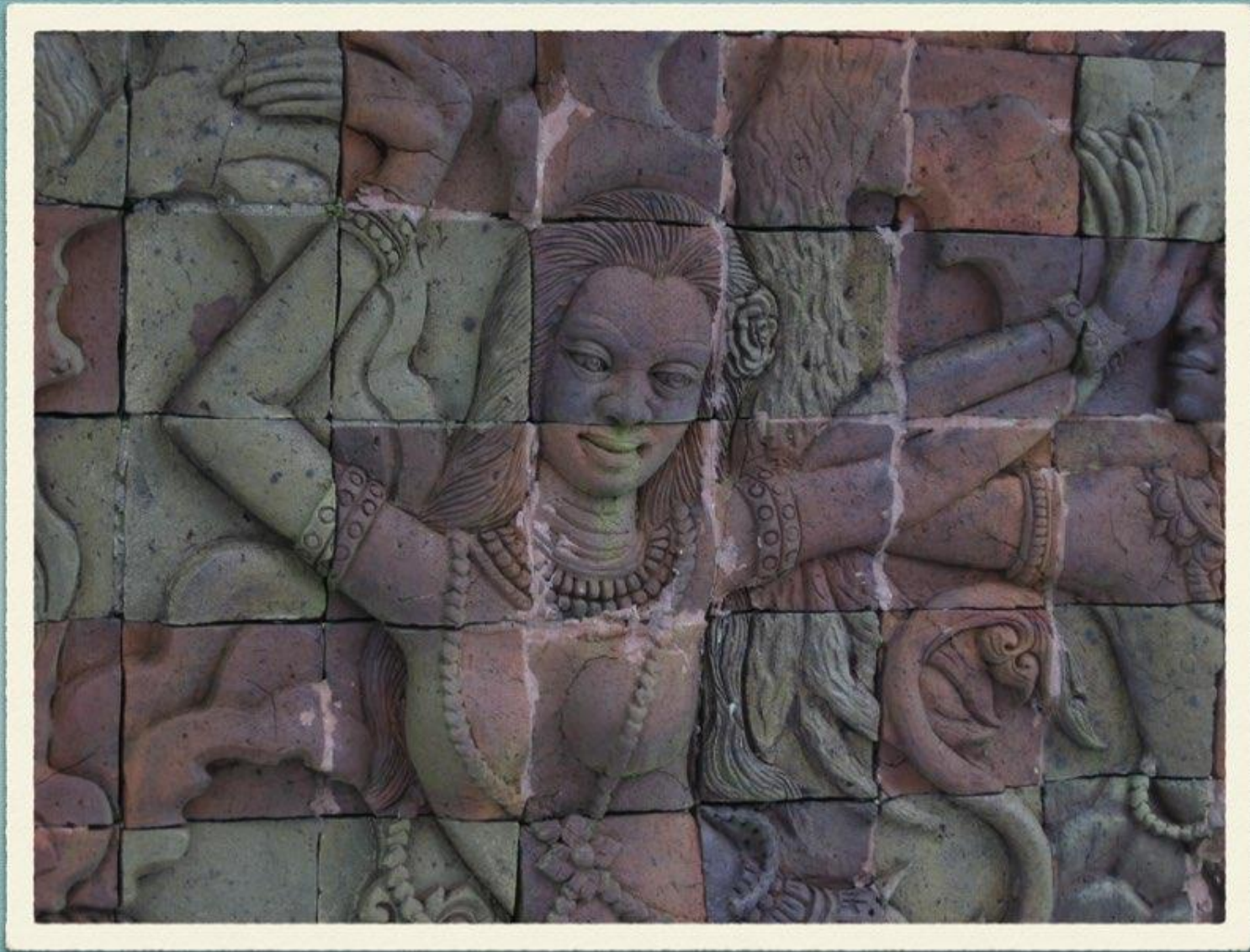
- Edema : 40 (grade 1-2)
- Rash : 8 (grade 1-2)
- Pain: : 8 (grade 1-2)
- Recurrence : 10

# SUMMARY

IORT AT KCMH (14+ YEARS)

- *Very beneficial in ELDERLY*
- *Mostly used as a BOOST Dose*
  - *Time to WBRT 2 - 38 wks (median 18 wks)*
- *Dense Breasts => More Fat Necrosis*
  - *FU Breast Imagings every 6 mo. for 2 years*





Q&A



# FUTURE IS **BRIGHT**

+ *More Vigorous* in Patient Selection

