

Obstacles to Effective Treatment of Breast Cancer in Developing Countries

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- A key determinant breast cancer outcome; newly diagnosed cancers are treated correctly in a timely fashion
- Available resources must be applied in a rational manner to optimize population based outcomes
- Breast cancer treatment: multidisciplinary approach
 - Pathology
 - Radiology
 - Surgery
 - Radiation Therapy
 - Systemic Treatment

Obstacles to Effective Treatment of Breast Cancer Radiation Therapy

1. The role of radiotherapy in the treatment of breast cancer
2. Requirements for safe and effective radiotherapy
 - Equipment
 - Human resources
 - Other requirements
3. Consequences of limited resources and requirements

The Role of Radiation Therapy in the Treatment of Breast Cancer

- Early and locally advanced disease
 - Major impact on local control
 - Improved survival (safe and effective)
- Metastatic disease
 - Effective tool to provide palliation

- The role of radiotherapy in the treatment of breast cancer
- *Requirements for safe and effective radiotherapy*
 - Equipment*
 - Human resources*
 - Other requirements*
- Consequences of limited resources and requirements

Requirements for Safe and Effective Radiation Therapy for Breast Cancer

Table 1. Roles of Staff and Equipment Requirements in Safe and Effective Radiotherapy for Breast Cancer (6)

Requirement	Role(s)
Staff	
Radiation oncologist	Clinical evaluation, therapeutic decision, target volume localization, treatment planning, simulation/verification of treatment plan, treatment evaluation during treatment, follow-up examinations
Medical physicist	Quality control, computerized treatment planning, complex calculations and quality checks
RTT	Simulation/verification of treatment plan, routine calculations and quality checks, treatment
Maintenance technician ^a	Maintenance of equipment
Equipment	
Megavoltage teletherapy unit ^b	Radiation source
Dosimetry equipment	Physical quality assurance
Clinical QA equipment ^c	Clinical quality assurance
Immobilization devices	Accuracy of therapy
Shielding devices	Protection of healthy tissues such as heart, lungs, and spinal cord
Treatment planning computer system	Calculation of radiation distribution

WHO Recommendations

- 1 Radiation Oncologist /250 new cancer patients
- 1 Megavoltage equipment / 300 new patients
- 5 Megavoltage equipment / 1 million population
- Actual supply of megavoltage equipment is only 18% of the estimated need.

Barton et al. Lancet Oncol. 2006;7:584-595.

Cobalt-60

Linear accelerator

Advantages

Disadvantages

Advantages

Disadvantages

- Cheaper
- More simple mechanical, electrical components and operations
- Easy to maintain
- Relative constancy of beam out-put, predictability of decay
- QA program is simple

- Poor field flatness
- Lower % depth dose
- Greater penumbra
- Lower dose rate
- Less favorable beam out-put
- Need of changing source every 5 years
- Inability to deliver complex treatments

- Ability of delivering complex treatments
- Better dose distribution especially after BCS*
- Decreased skin dose especially after BCS
- Decreased dose to the contralateral breast

- Preventive maintenance is essential, expensive and requires a maintenance technician
- More detailed QA program is needed

Other Requirements

- Maintenance of the equipments
- Education of the staff and patients
- Logistic issues, geographic accessibility, support systems
- Social security for health

- The role of radiotherapy in the treatment of breast cancer
- Requirements for safe and effective radiotherapy
 - Equipment
 - Human resources
 - Other requirements
- *Consequences of limited resources and requirements*

Initiation of RT in a timely manner

- Limitation of the radiation therapy resources (equipment and human resources)
 - waiting lists
- Lack of transportation and support systems
- Lack of awareness of the importance of initiation of RT after surgery in a timely manner

RT or CT after breast conserving surgery

Median Follow-up 135 months

	<u>RT first</u>	<u>CT first</u>	
Distant metastases	33 %	25 %	NS
Local recurrence	11 %	16 %	NS
No recurrence	48 %	47 %	NS
Overall survival	67 %	72 %	NS

Bellon; J Clin Oncol 2005;23:1934

BCS-RT interval without CT SEER DATA

- n= 13.907 Stage I-II
age >65

Delay >3 months higher overall mortality
RR=1.92 (1.64-2.24)

Hershman IJROBP 2006;65:1353

Duration of Radiation Therapy

- Main principles of fractionated RT; complete without interruptions
- Machine breakdowns
- Machine servicing
- Public holidays; lack of staff, payment
- Transportation-support systems
- Early RT toxicity
- Inter current disease

Duration of Radiation Therapy

n= 853 breast cancer patients,
Post-operative radiotherapy

Table 1. Distribution of the variables and the results of the univariate analyses as regards LC

Variables	Patients		5-year LC, %	10-year LC, %	p value
	n	%			
Age					
≤ 40 years	223	26	86	82	0.005
>40 years	630	74	92	89	
Menopause					
Premenopause	436	51	88	83	0.002
Postmenopause	417	49	94	92	
Histology					
Ductal	686	80	91	88	0.788
Nonductal	167	20	91	86	
Grade					
GI	181	21	91	87	0.754
GII	333	39	91	89	
GIII	184	22	89	86	
Unknown	155	18	92	88	
Hormone receptor					
Positive	59	7	86	86	0.19
Negative	185	22	95	93	
Unknown	609	71	90	87	
pT stage					
T1	328	73	91	87	0.055
T2	436	62	92	89	
T3	59	49	79	79	
T4	13	43	92	92	
TX	17	50	76	76	
pN stage					
N0	268	31	89	85	0.008
N1-3	300	35	95	93	
≥ N4	265	31	87	83	
No axillary dissection	20	3	100	90	
Surgery					
Mastectomy	546	64	92	90	0.058
Conserving surgery	307	36	89	83	
Adjuvant treatment					
No treatment	137	16	89	85	0.011
CT	336	39	87	82	
Tamoxifen	270	32	94	93	
Both	110	13	94	94	
Number of gaps (n = 741)					
1 gap	164	22	93	87	0.473
>1	577	78	90	87	
Duration of interruption					
Groups A+B	348	41	94	90	0.019
Groups C+D	505	59	89	86	

Bese et al, Oncology 2005;69:214-223

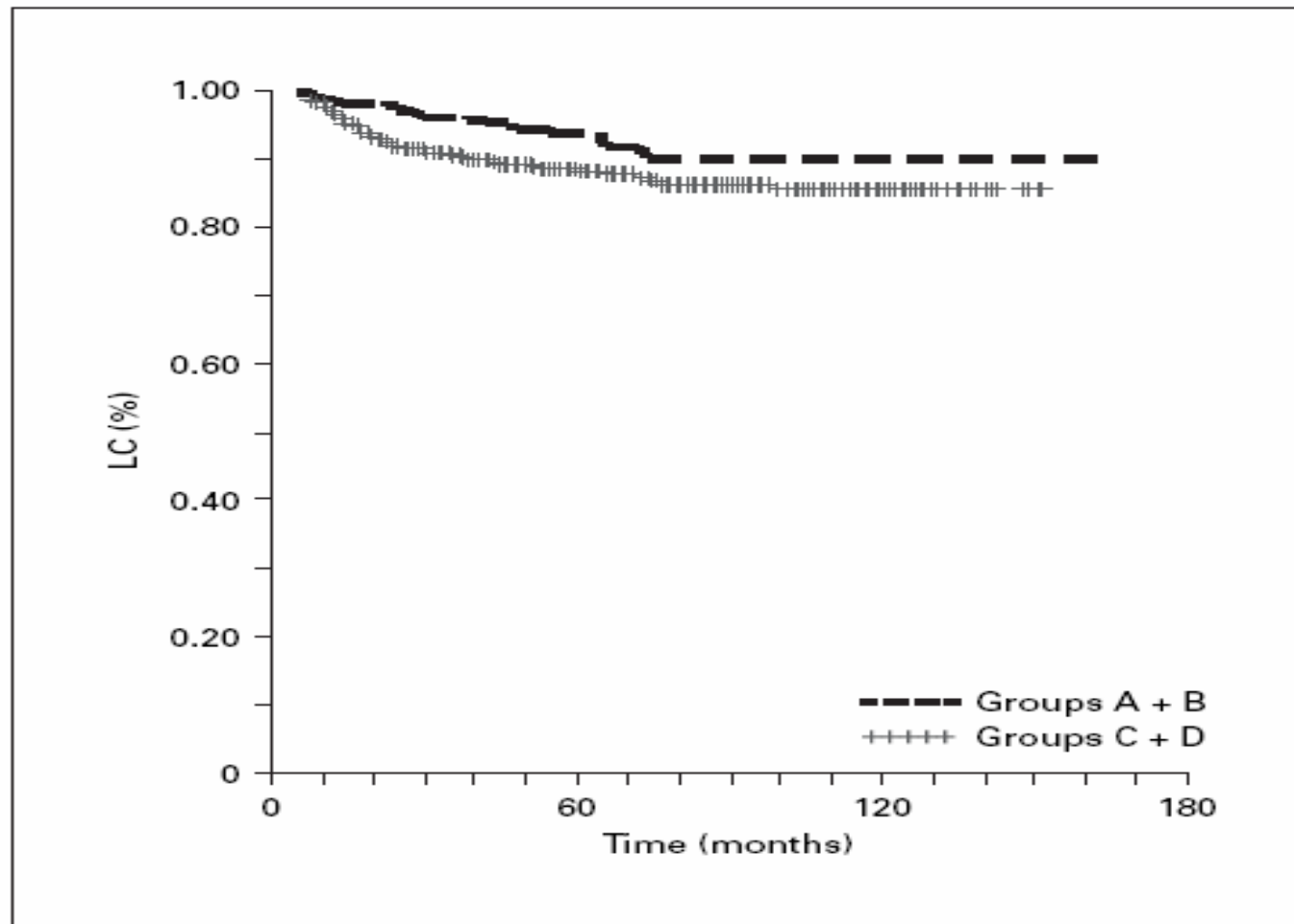


Fig. 3. Comparison of the patients with no treatment break and interruptions of 1 week or less with the patients who had treatment interruptions of more than 1 week for LC. The difference was statistically significant ($p = 0.019$).

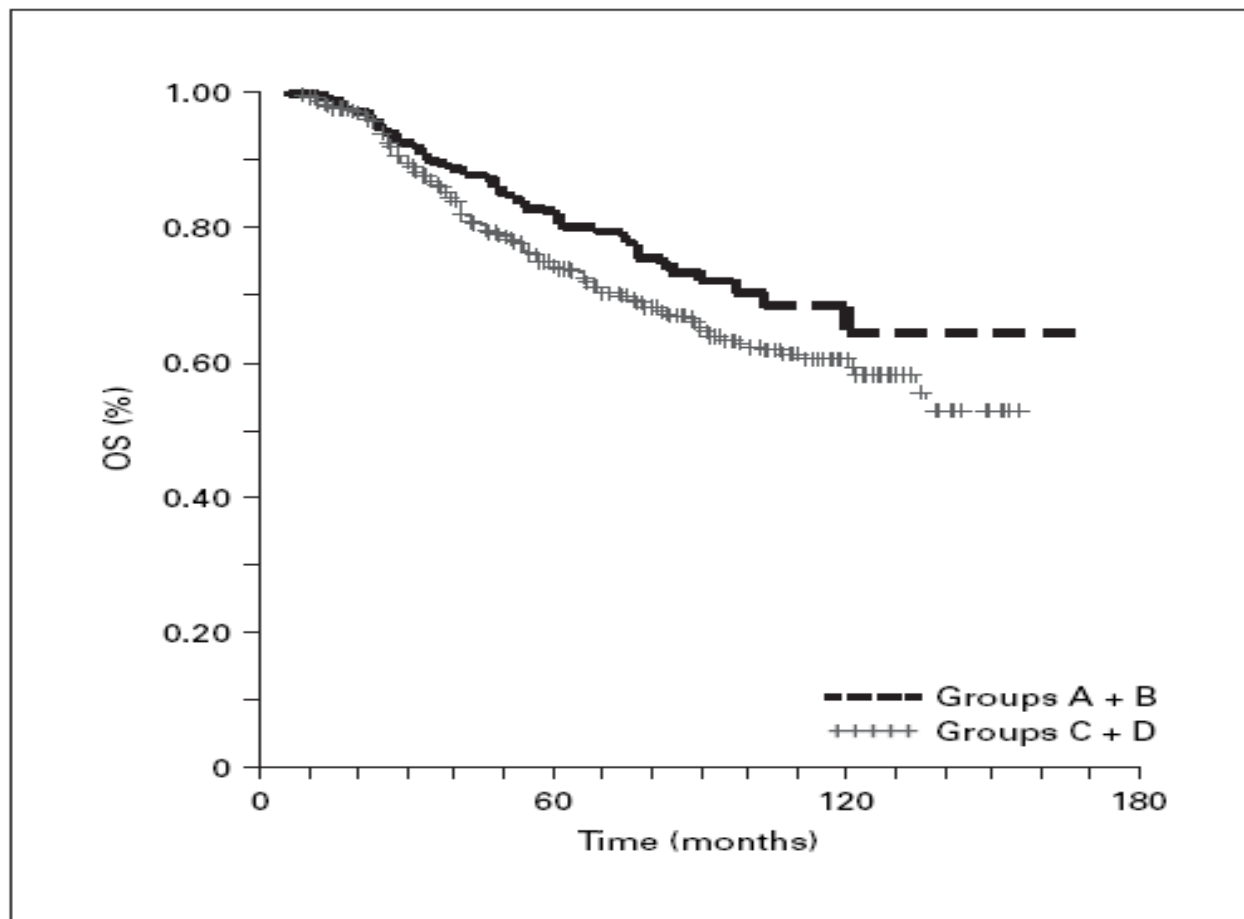


Fig. 4. Comparison of the patients with no treatment break and interruptions of 1 week or less with the patients who had treatment interruptions of more than 1 week for OS. The difference was statistically significant ($p = 0.026$).

Bese et al, Oncology 2005;69:214-223

Table 3. LC rates and comparisons of the groups according to the type of surgery

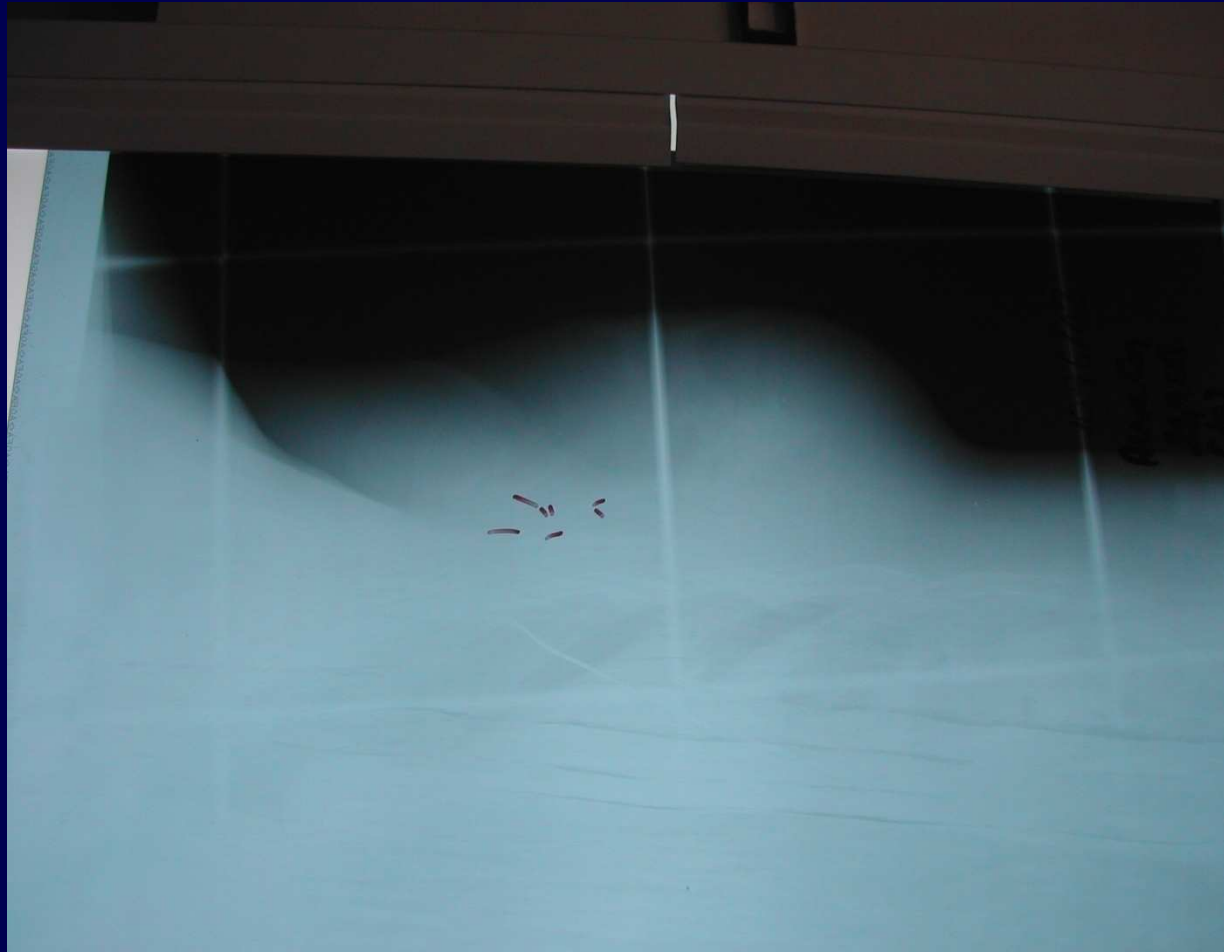
Type of surgery	LC, %		p value
	5 years	10 years	
Breast conserving			
Groups A+B (n = 106)	94	88	0.069
Groups C+D (n = 201)	87	81	
Mastectomy			
Groups A+B (n = 242)	94	90	0.209
Groups C+D (n = 304)	90	89	

Variables	RR	95% CI	p value
Menopause (postmenopausal vs. premenopausal)	1.963	1.227–3.140	0.005
Duration of interruption (groups A+B vs. C+D)	1.665	1.017–2.728	0.043

RR = Relative risk; CI = confidence interval.

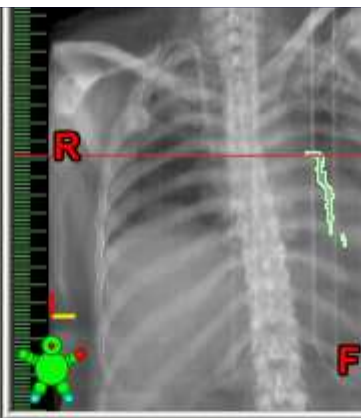
Obstacles to Safe Radiation Treatment of Breast Cancer

- Every 4 prevented local recurrences resulted in one avoided breast cancer death
- Unwanted irradiation to heart increased mortality from heart disease (27% CI- 13-41%)
[EBCTCG; Lancet 2005;366:2085-2106](#)
- Cardiac mortality is 16% higher in women with left-sided breast cancer
[Darby s; Lancet Oncol 2005;6:557-565.](#)
- Cardiac effects occur 10-15 years after RT
[Saphiro, Recht :NEJM 2001: 344;1997](#)
- Cardiac dose is decreased as the technology increased





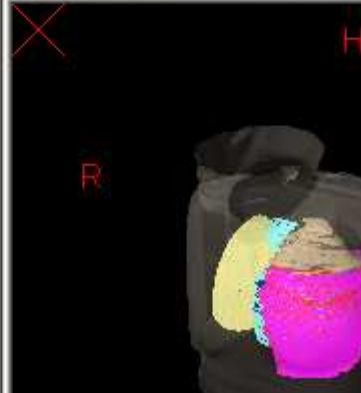
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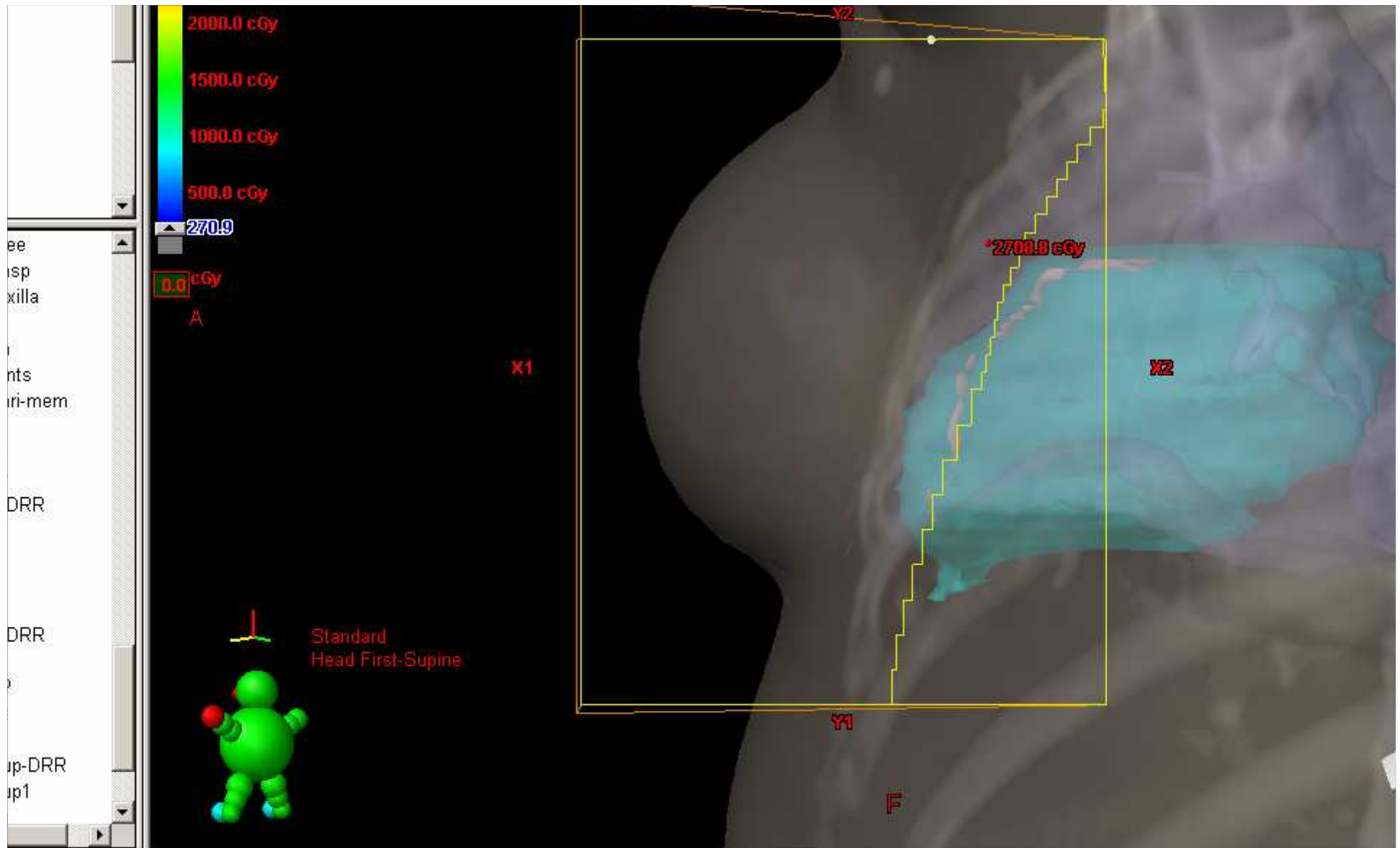


Sagittal - CT free



Model View





Contouring | **Field Setup** | Plan Evaluation

Field Alignments |
 Plan Objectives |
 Optimization Objectives |
 Dose Statistics |
 Calculation Models

Technique	Machine/Energy	Weight	Scale	Gantry Rtn [deg]	Coll Rtn [deg]	Couch Rtn [deg]	Wedge	Field X [cm]	X1 [cm]	X2 [cm]	Field Y [cm]	Y1 [cm]	Y2 [cm]	X [cm]	Y [cm]	Z [cm]
TATIC-I	DHX-OBI - 6X	0.95	VAR_IEC	131.2	0.0	0.0	W15L20	15.0	+10.0	+5.0	19.0	+19.0	+0.0	2.5	-31.7	45.7
TATIC-I	DHX-OBI - 6X	1.05	VAR_IEC	307.1	0.0	0.0	W15R20	15.0	+5.0	+10.0	19.0	+19.0	+0.0	2.5	-31.7	45.7

- Cost of tele-therapy machines

200.000 \$-----5.million \$<

Possible Solutions for Effective Treatment of Breast Cancer in Developing Countries

- A wide spectrum of resources; basic-enhanced
- Minimum requirements should be defined
 - Diagnosis; Radiology-Pathology
 - Surgery-Radiation and Systemic Treatment
- Resource based guidance strategies should be defined
 - Adaptation of existing resources
 - Sequentially introduction of new resources
- Close collaboration of health care providers, health care ministry, advocates and other social workers
 - Awareness-deficits in public knowledge
 - Social and cultural barriers

