

Contouring of the breast, cavity and nodal regions

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SONGKRAN FESTIVAL SALE

CHIVARI

Forever
Cabriolet



Why is this issue important?

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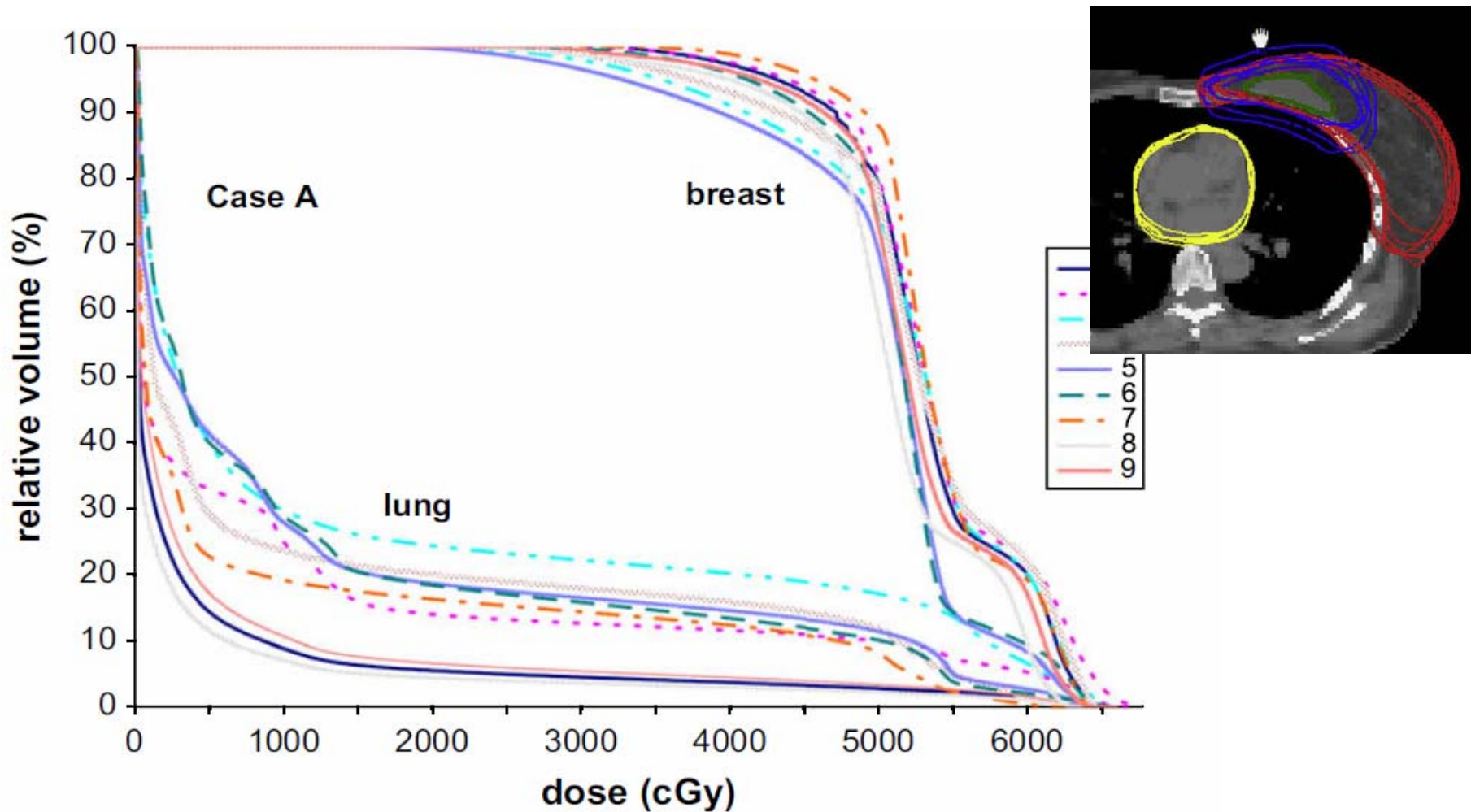
- ❖ Desirable to deliver a relatively uniform dose distribution inside the breast volume
- ❖ Excessive hot spots in the patient result in poorer cosmetic outcome
- ❖ Conformal RT/IMRT, has become an option for breast irradiation...offers reduced hot spots, increased normal tissue sparing

Why is this issue important?

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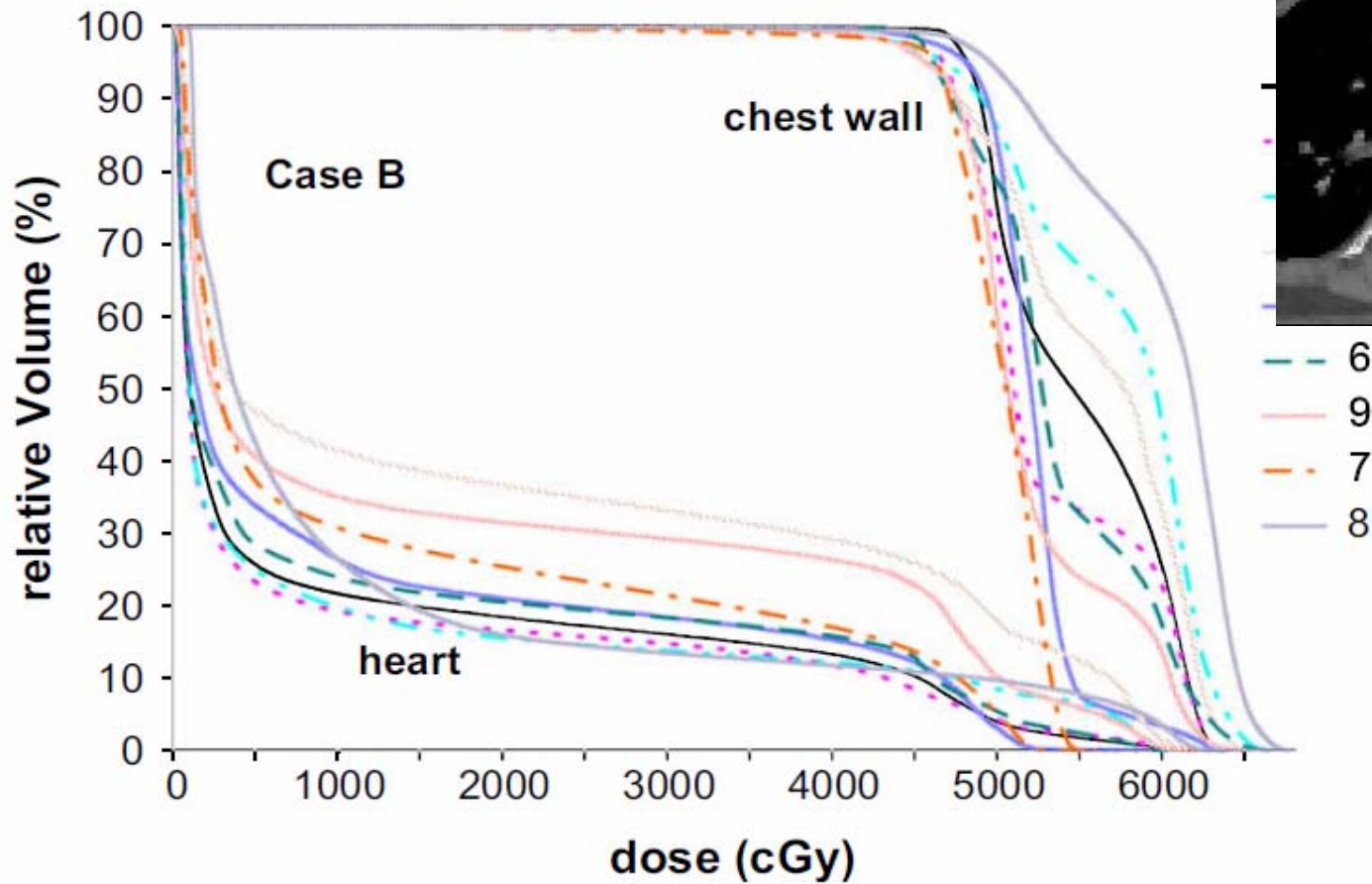
- ❖ Recently available image-guided RT (IGRT) can significantly improved accuracy of conformal treatment delivery
- ❖ Accurate delineation of volumes of the targets and OARs(heart,lung) is a prerequisite of and critical for conformal RT
- ❖ Emerging evidence for Hypofractionated radiotherapy schedules

Why is this issue important?



Allen X, IJROBP 2009

Why is this issue important?



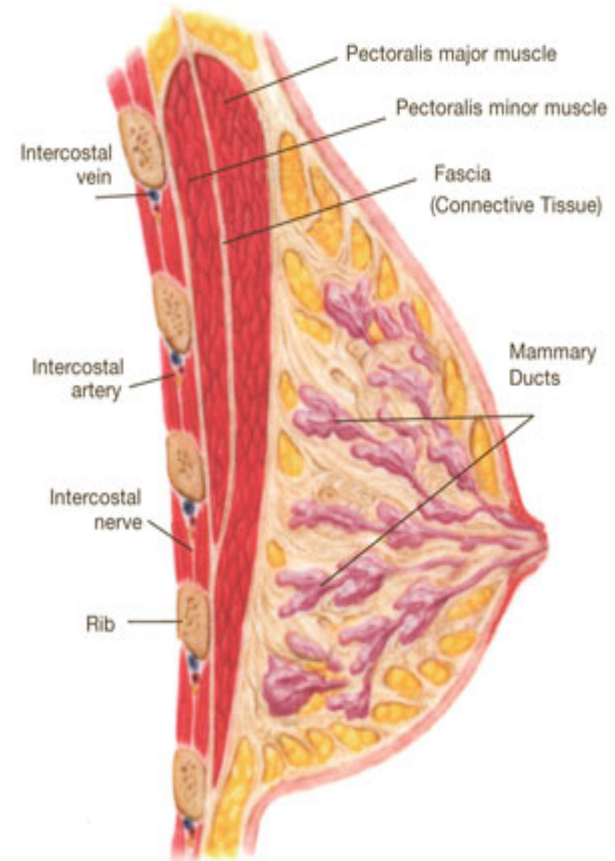
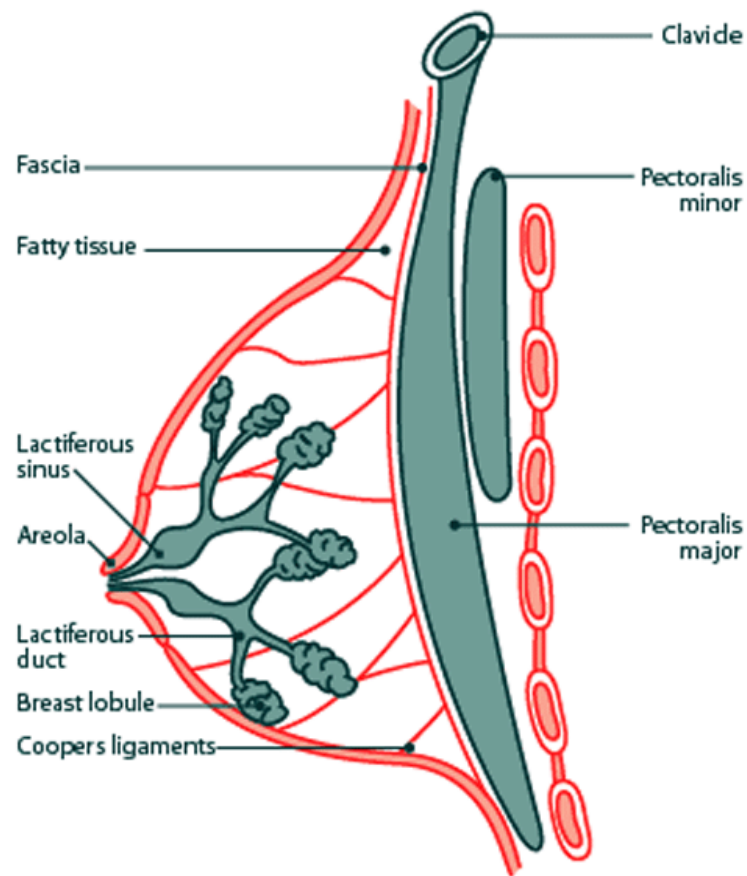
Allen X, IJROBP 2009



C O N T O U R I N G

Anatomy of the Breast

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Patient position/Immobilisation

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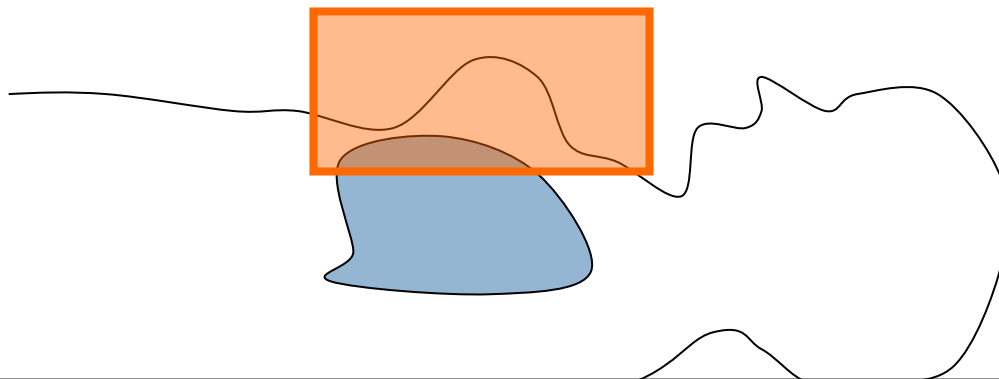
- Depends on the facilities available and the treatment technique
- Most common – Breast board (keeps the chest wall parallel to the couch and avoids too much collimation)
- Advantages- excellent for conventional simulator, 2 D planning
- Disadvantages- issue of getting a good clearance during CT based planning

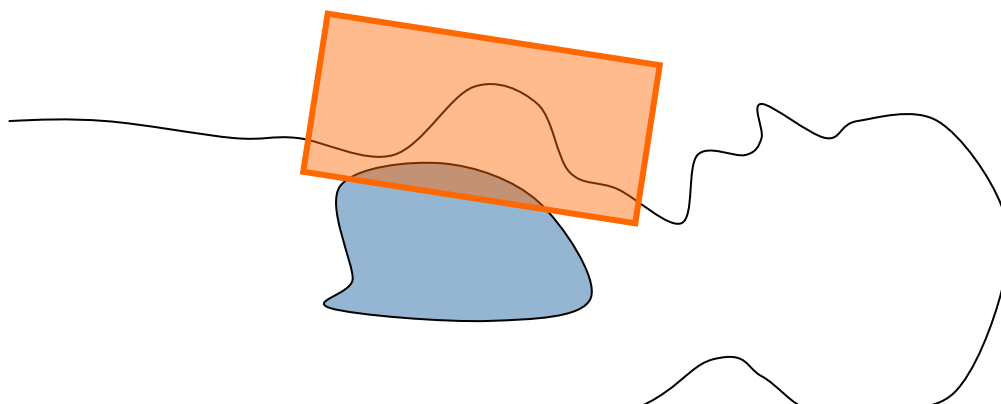
Patient position/Immobilisation

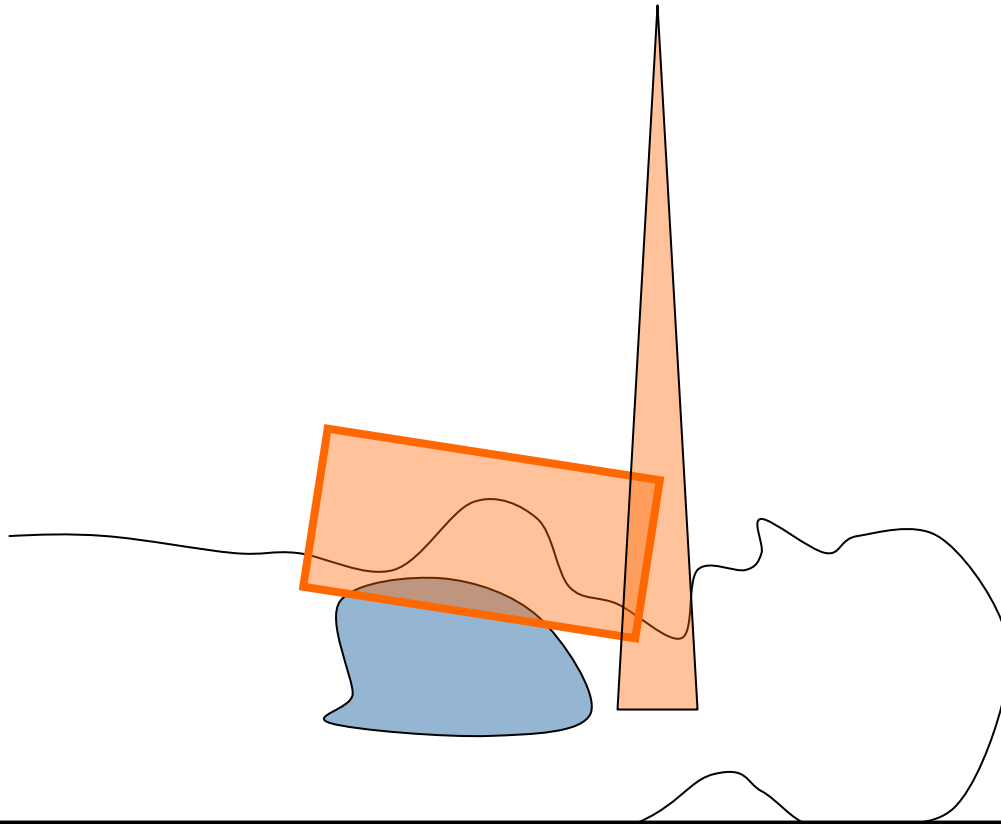
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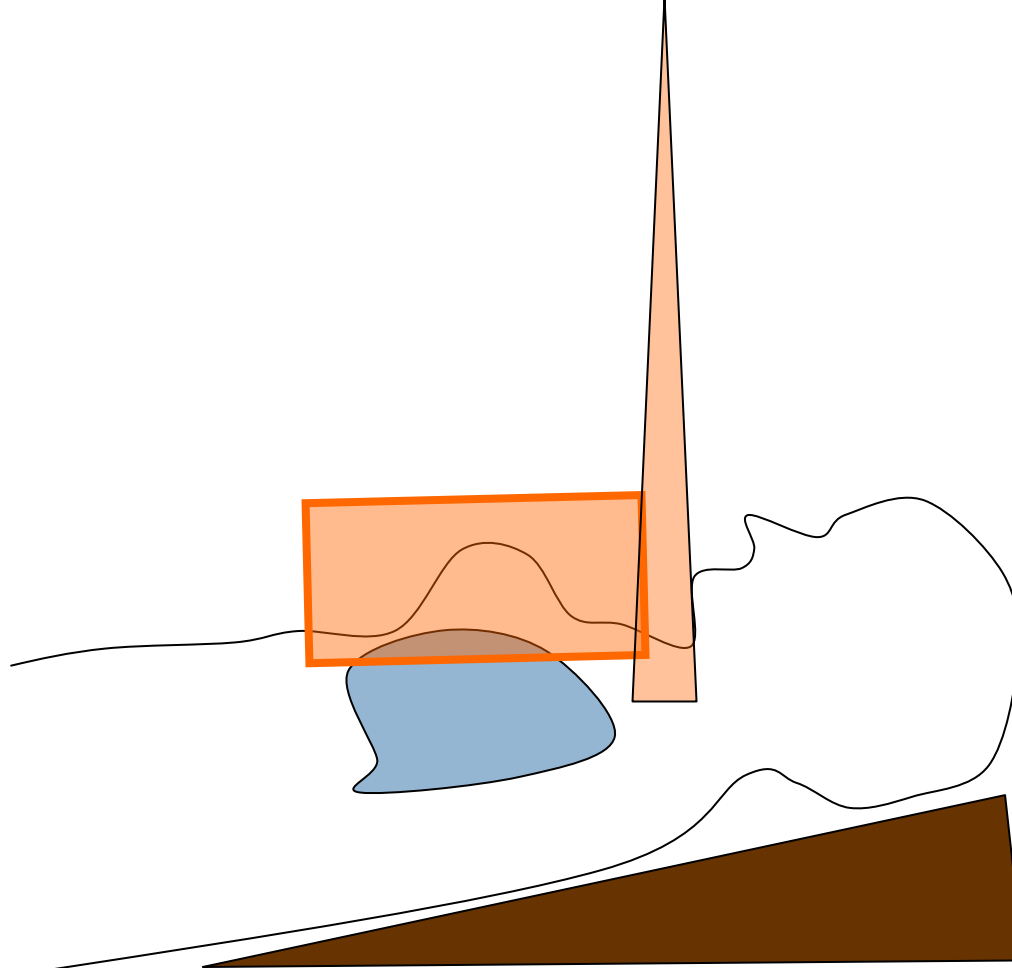
CT based simulation

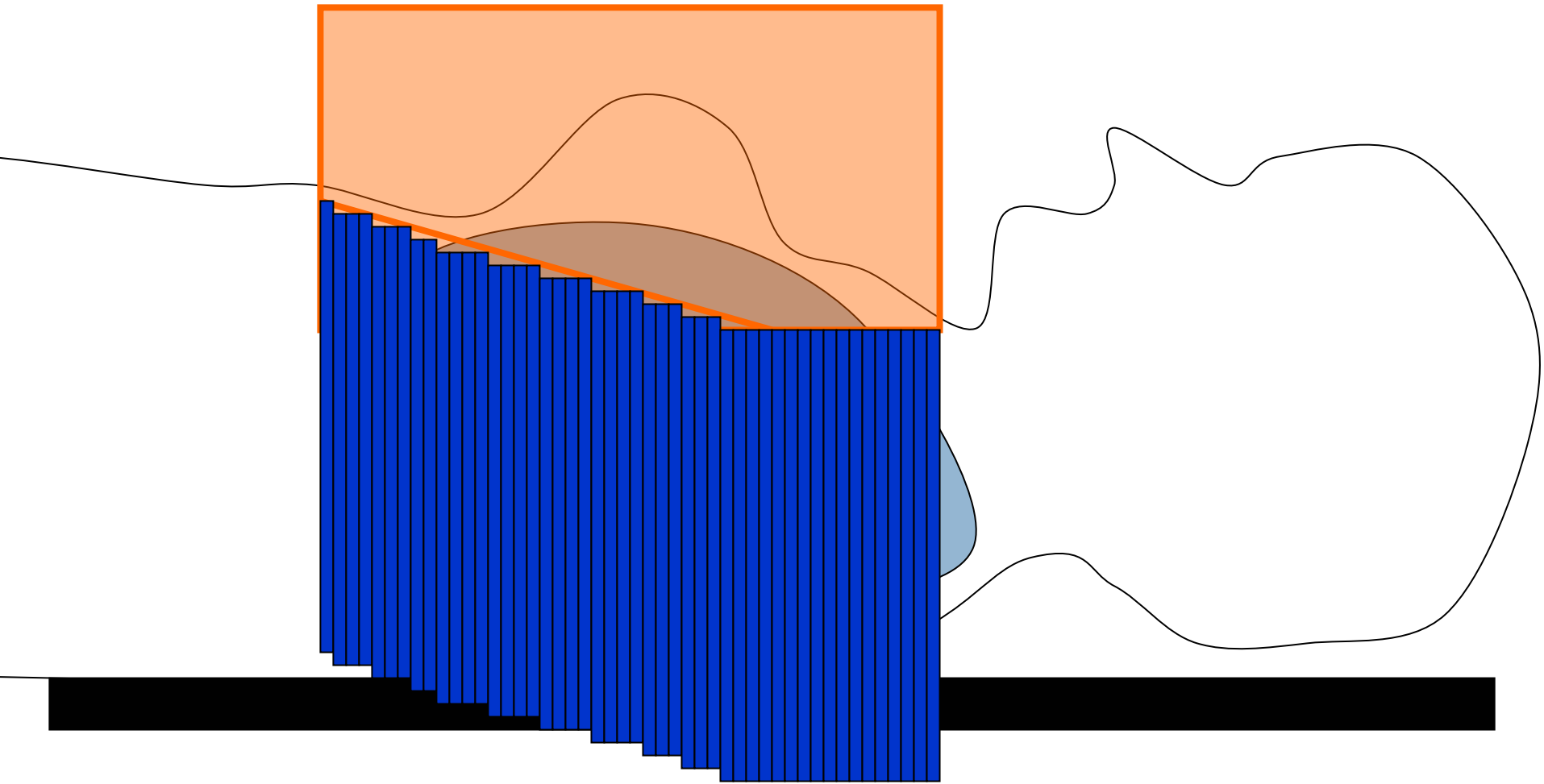
- Should have
 - ▣ Wide bore CT preferably
- Can circumvent breast board if we used MLC's for posterior border delineation
- While contouring, keep window width at 600 and window center at 40



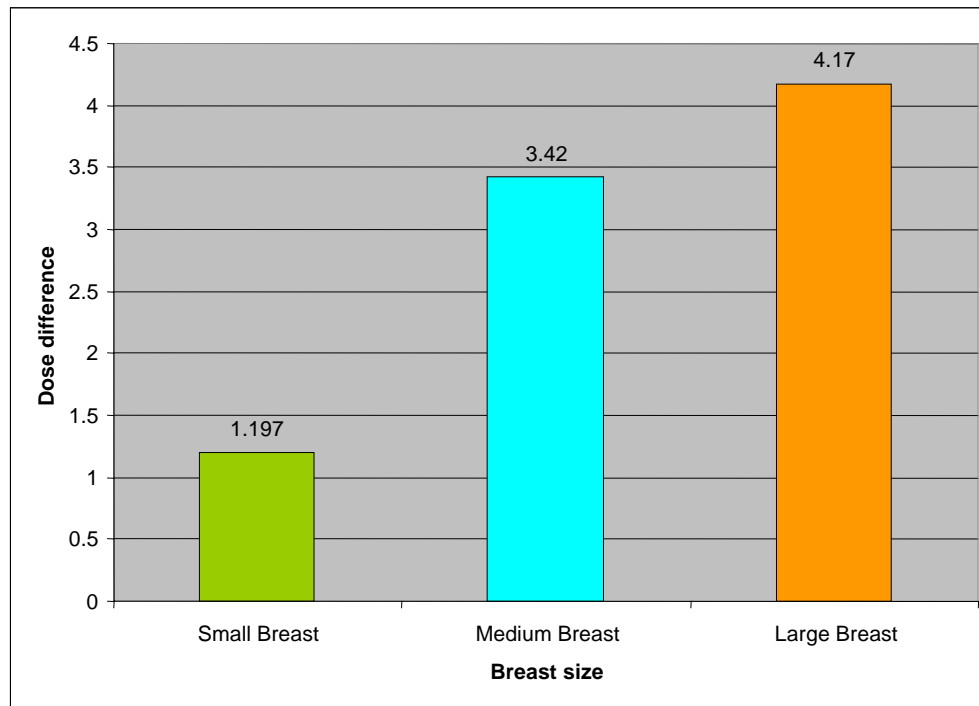
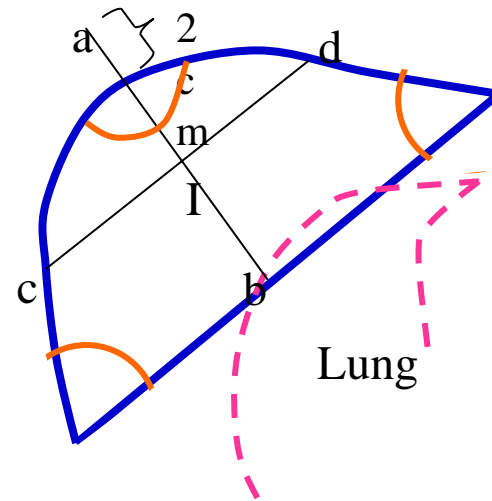
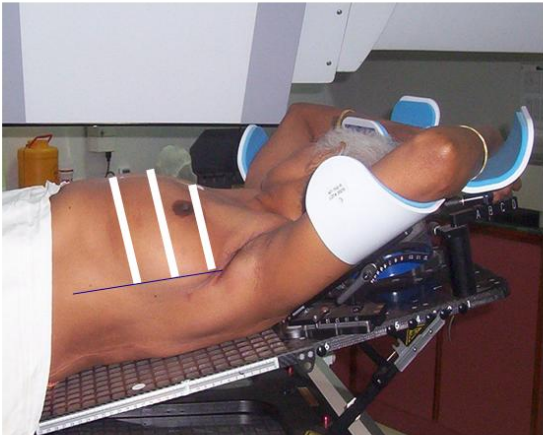








Inclination of patient/Breast board less relevant with modern
MLC based machines



Useful aids at CT cuts

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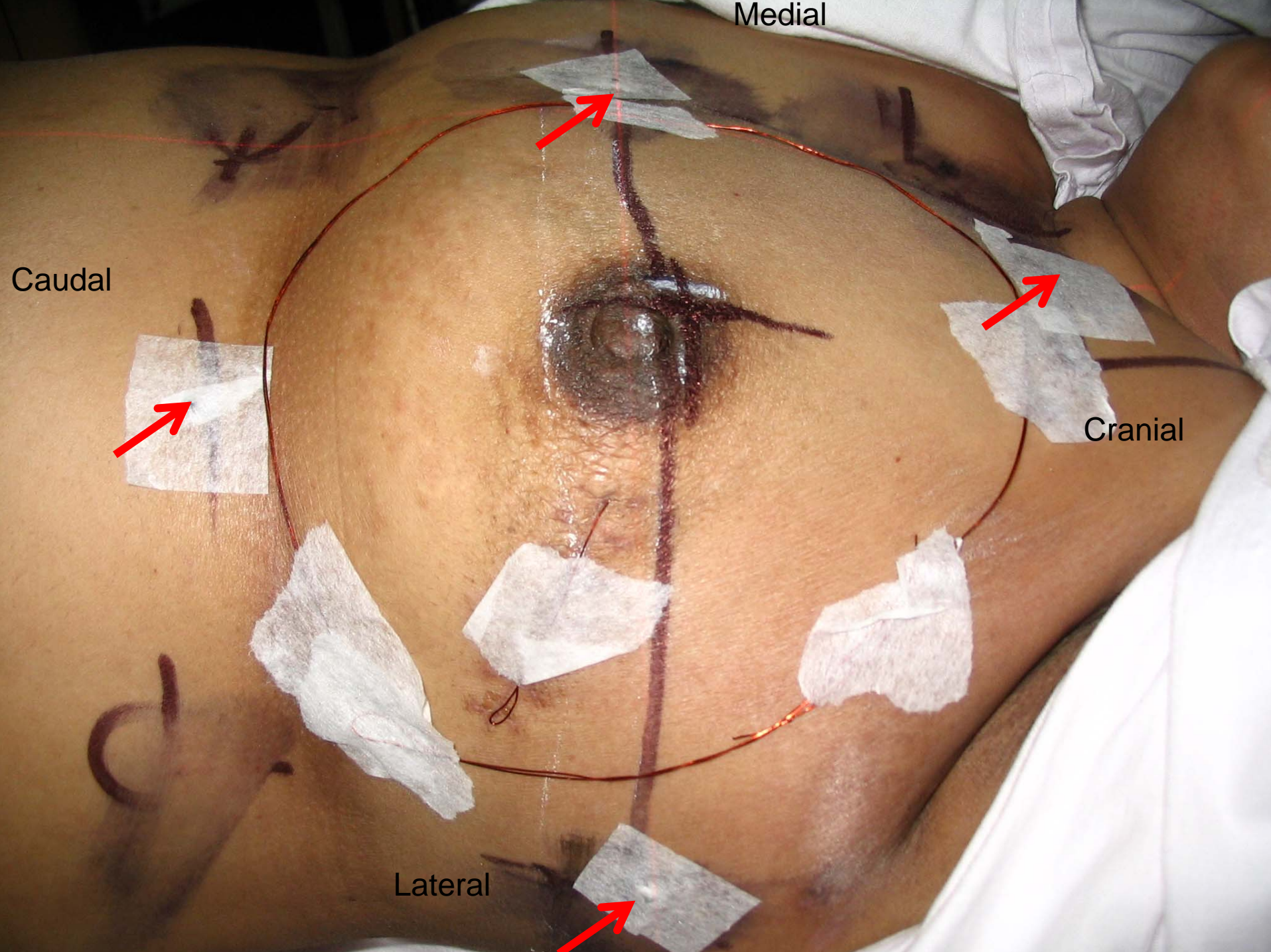
- Use copper wire to demarcate whole breast
- Laser to match with 2 lateral and one ant marker
- Ant marker also a surrogate for midline, lateral a surrogate for mid axillary line
- Place additional marker to be placed at a) 1.5 cm below inframammary fold
- Wire on the scar

Medial

Caudal

Cranial

Lateral

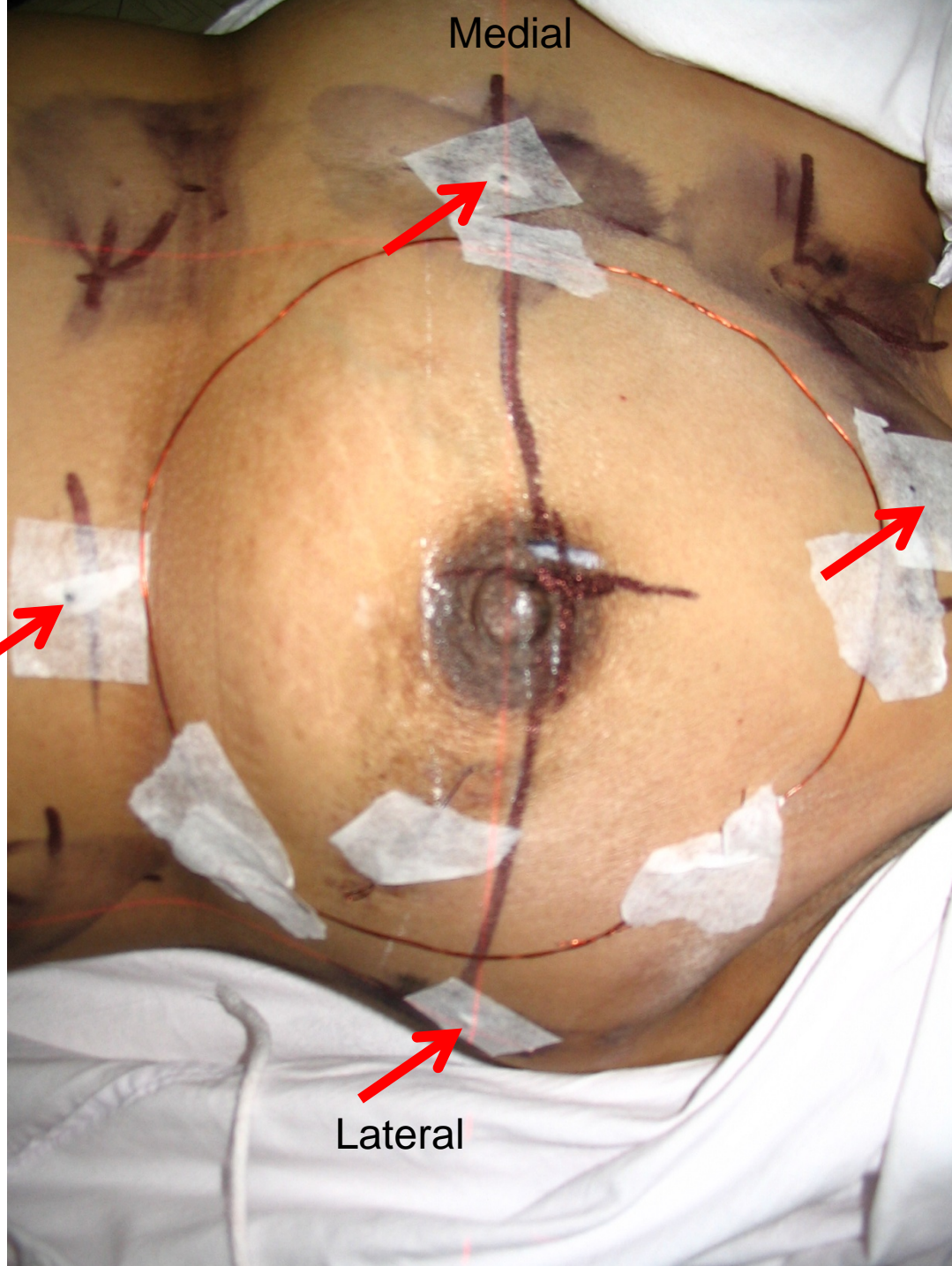


Caudal

Medial

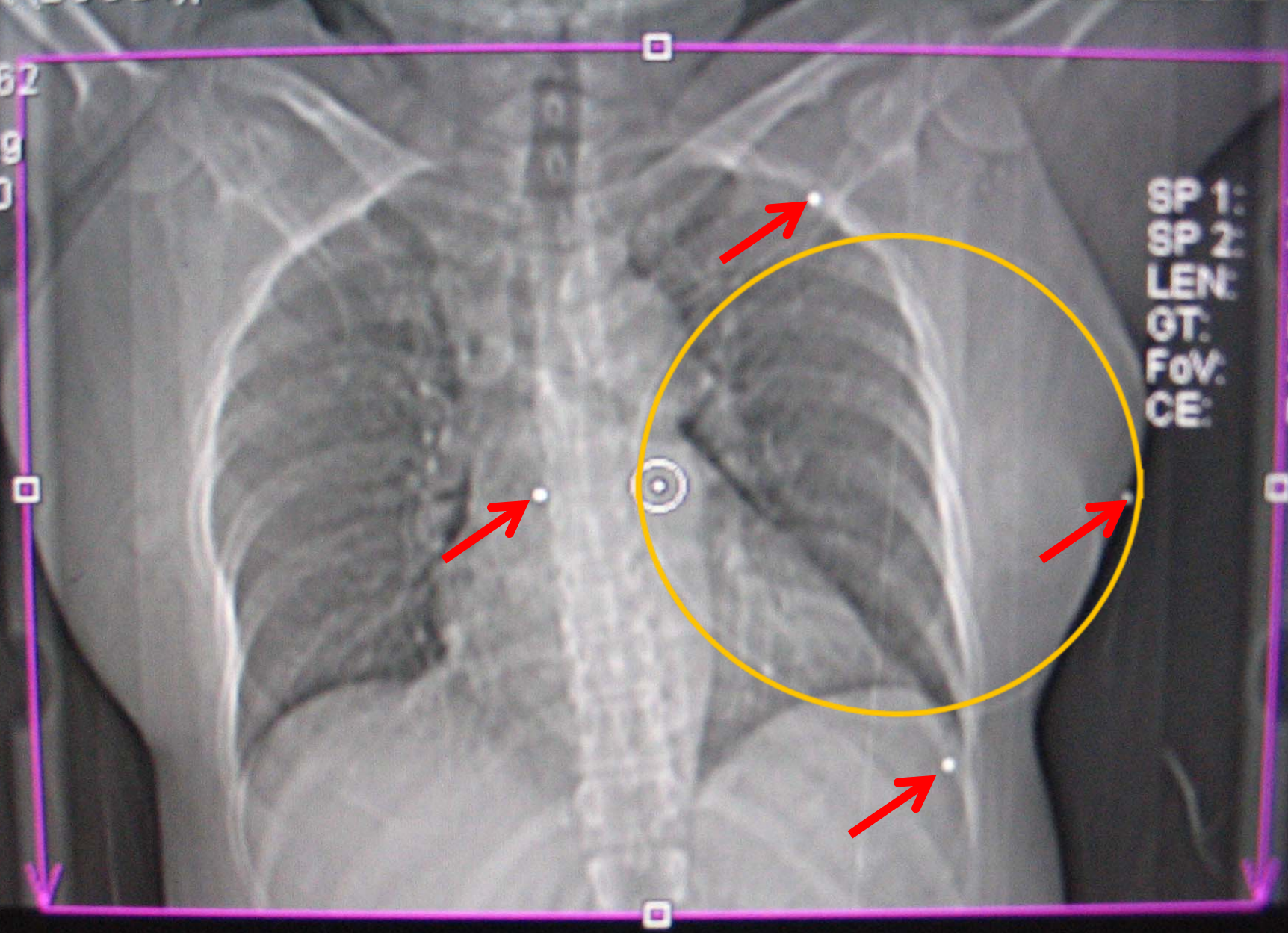
Cranial

Lateral



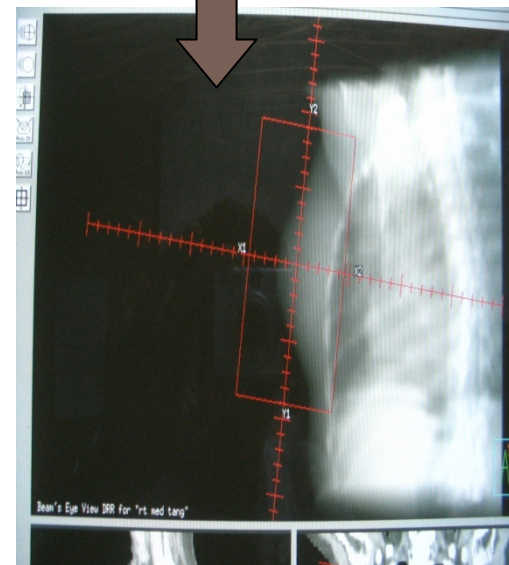
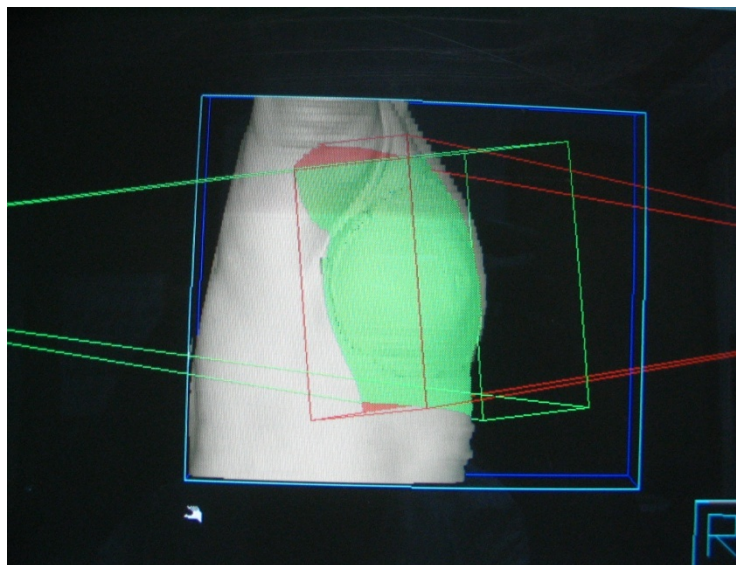
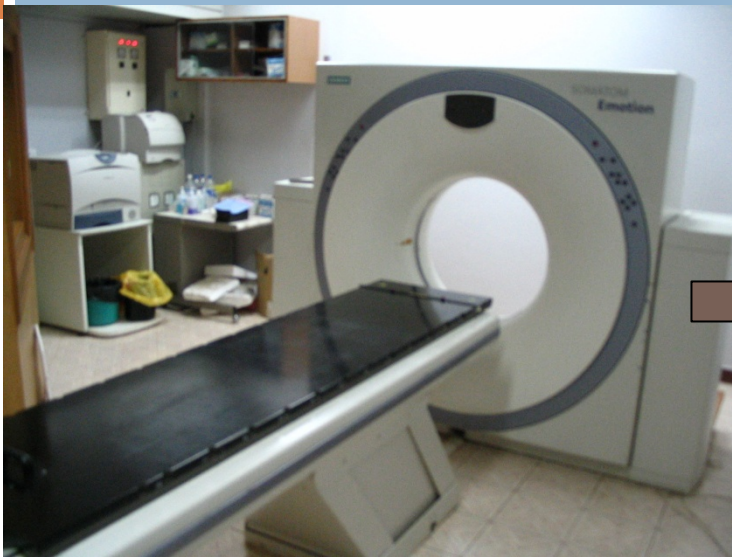
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SP 1:
SP 2:
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FoV:
CE:



CT simulation

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Gross tumour volume(GTV)- Breast

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- Not relevant for breast cancers
- All cases present to the radiation oncologist after lumpectomy or mastectomy
- Even if cut margins are positive (usually microscopic), difficult to image the gross disease
- May have relevance in selected nodal regions

Clinical target volume(CTV)- Breast

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- Aim to include all breast tissue
 - ▣ Challenges
- Except posteriorly, the rest of the margins are difficult to define precisely
- CT too not helpful to delineate breast tissue
- Often breast tissue merges with fat, especially laterally in thick patients

Breast tissue- boundaries

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- Medially lateral edge of sternum
- Cranially sternoclavicular joint
- Usually ends within 5 mm of skin surface(CAUTION - do not extrapolate this to the post mastectomy contouring!)
- Caudally inframammary fold

Special tips!

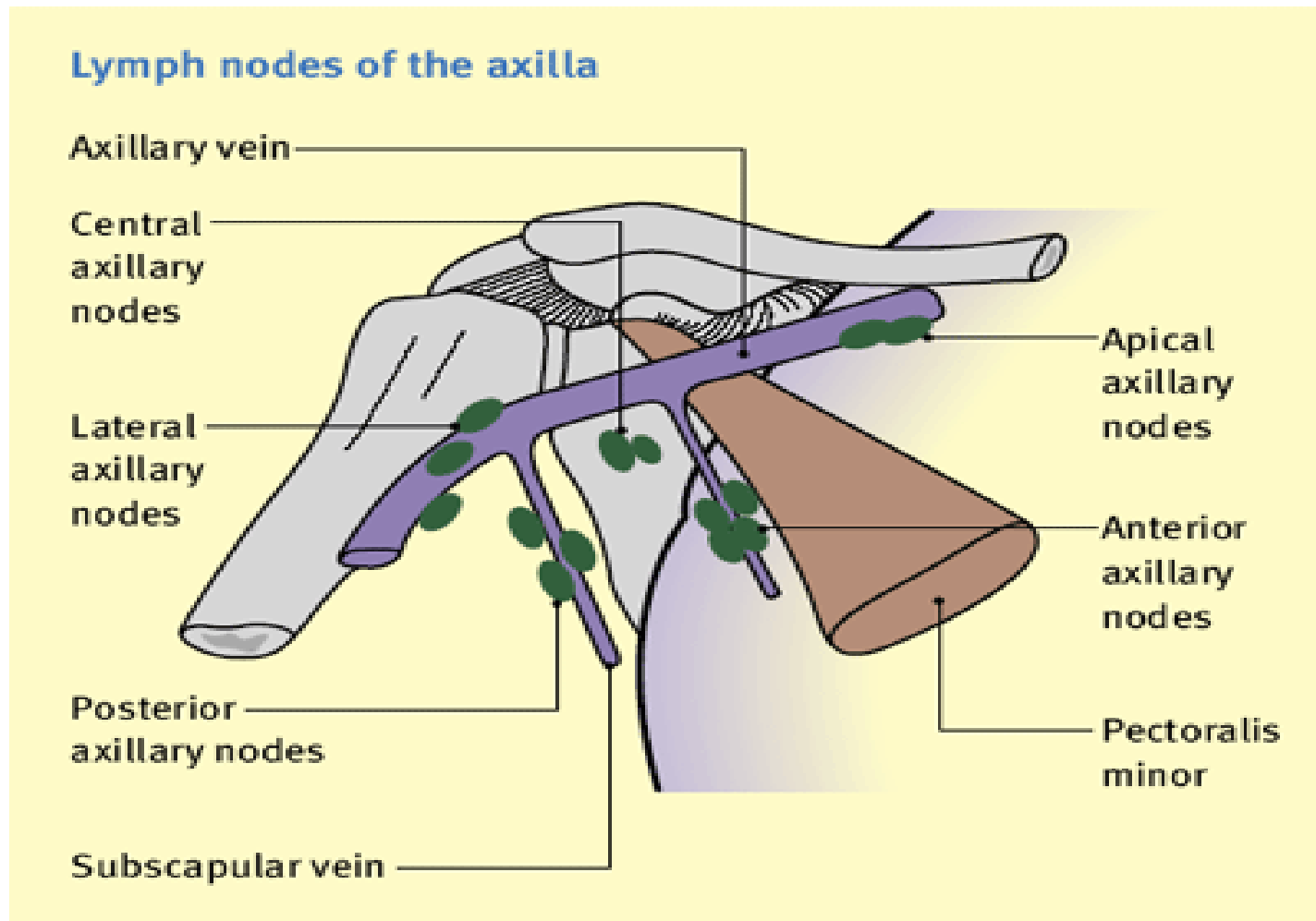
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- Remember to contour the tumour bed/cavity even while planning whole breast radiotherapy
- For cardiac sparing- Careful and smart alteration of the lateral border(less commonly medial) or MLC's(Don't shield the target!)
- Remember to make use of back up markers at the “clinical borders” while placing tangents

Nodal Contouring

SCF/ Axillary irradiation issues

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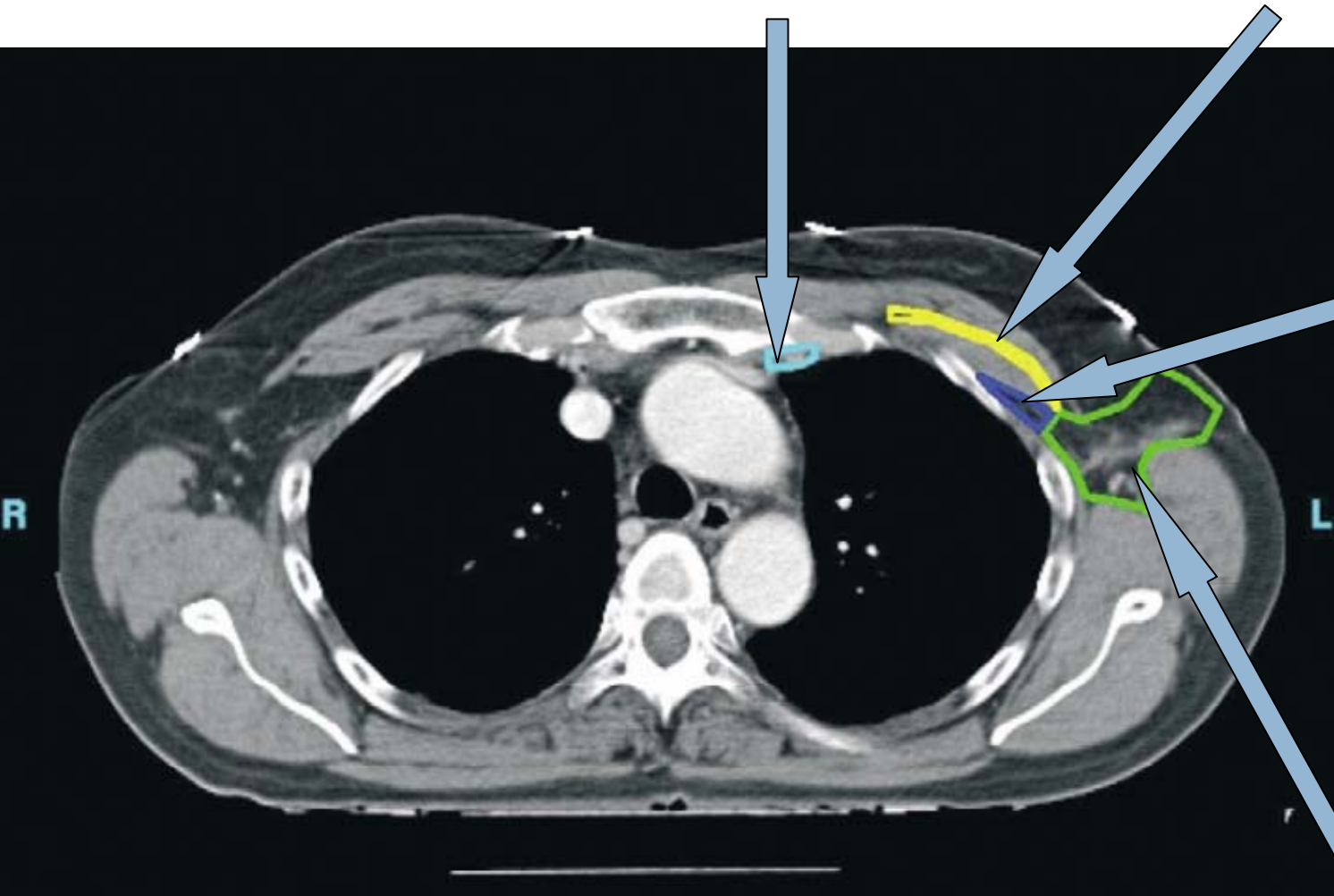


Internal Mammary

Interpectoral

**Level II
nodes**

Level I nodes

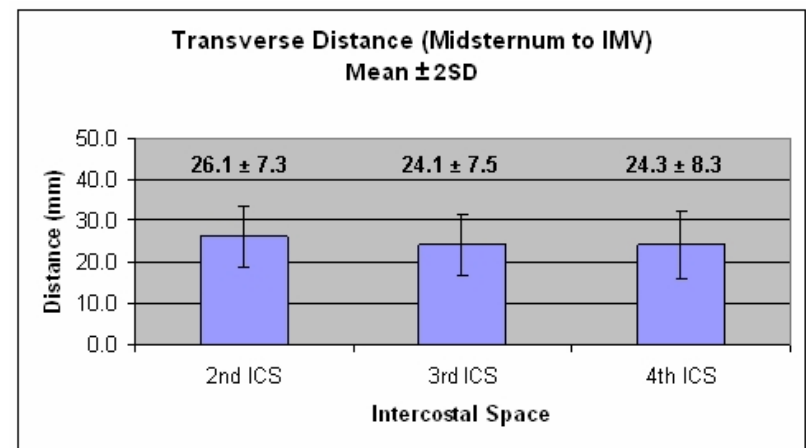
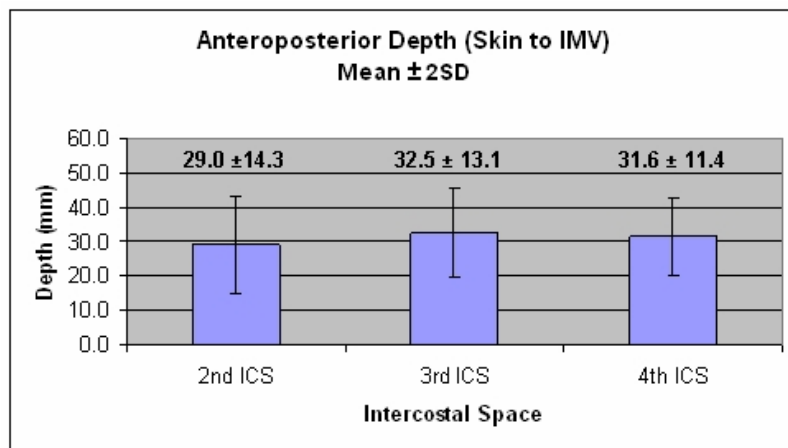
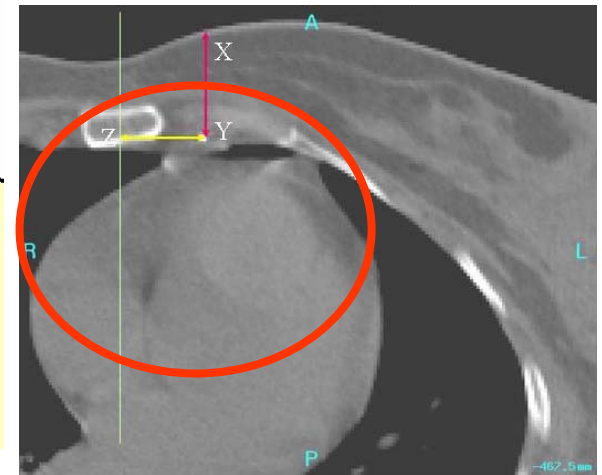
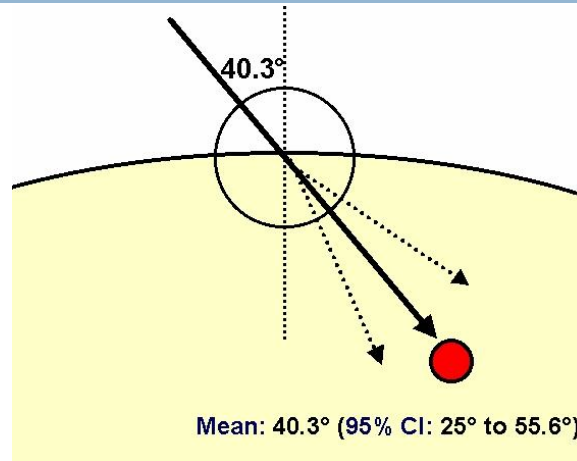
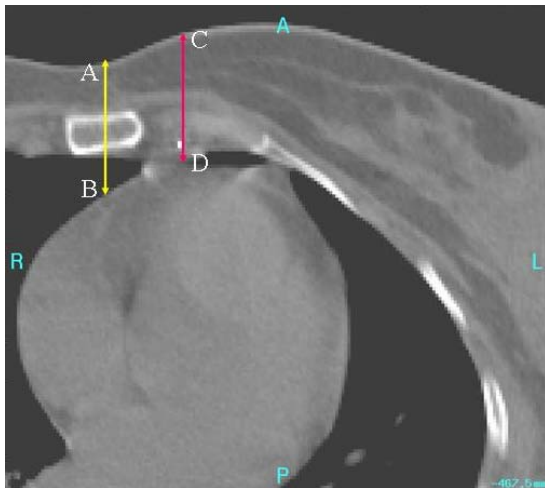


Internal mammary nodal contouring

Uniqueness of position of IMC

51 patients with breast conservation and IMC catheterisation at Tata Memorial Hospital

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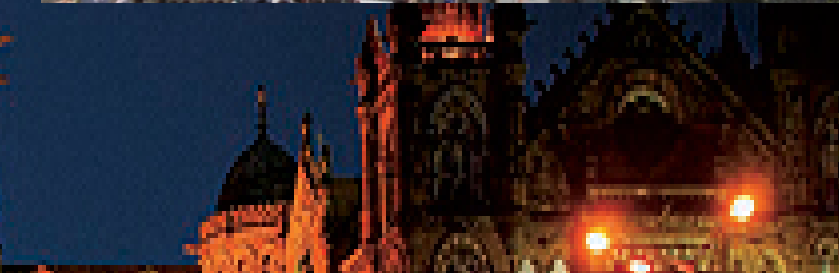
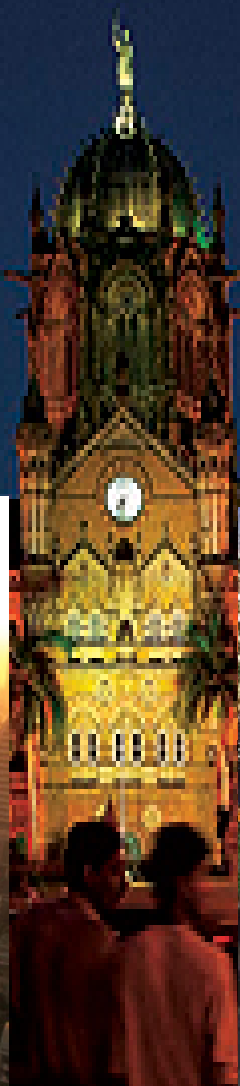
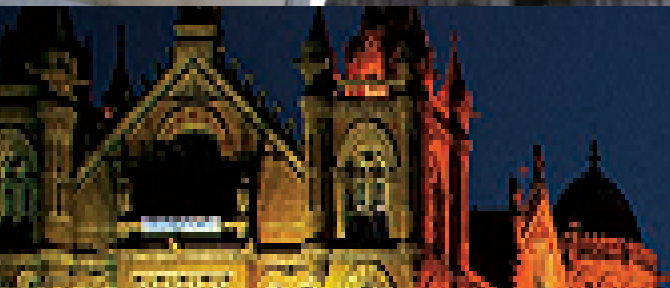


A Munshi et al BJR 2007

Contouring the Brachial plexus

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1. Identify and contour C5 to T2
2. Identify and contour anterior and middle scalene muscles from C5 to insertion onto the first rib
3. Contour the brachial plexus OAR use a 5-mm diameter paint tool.
6. Contour from lateral aspect of the spinal canal to the small space between the anterior and middle scalene muscles
7. Contour inferiorly and laterally to one to two CT slices below the clavicular head
8. The first and second ribs serve as the medial limit of the OAR contour



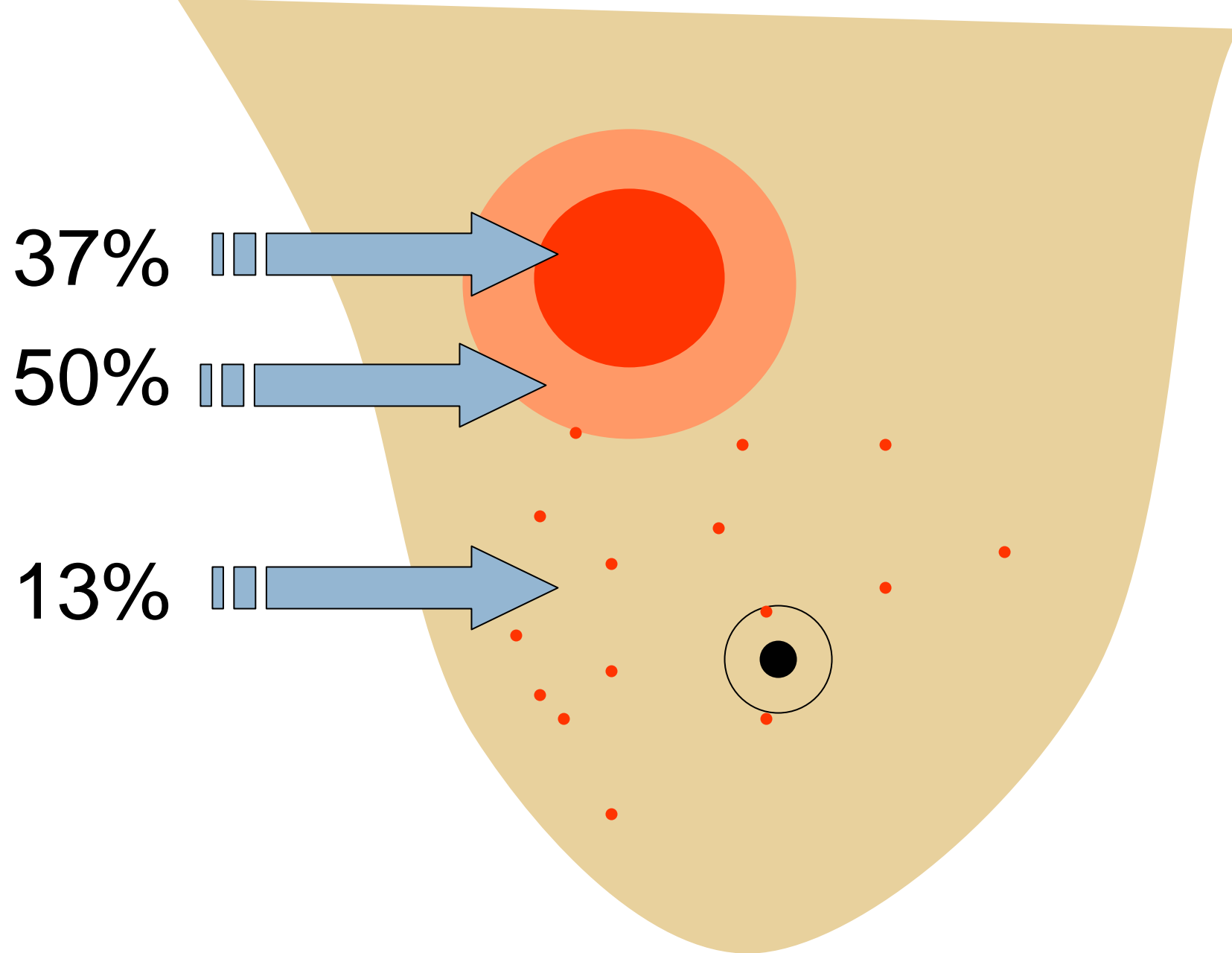
Tumour bed/cavity contouring

Pathological Data

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Author		No. of pts/ Specimens	No MCF*	MCF in index quadrant/tumor bed	MCF elsewhere in ipsilateral breast
Holland et al.	Cancer 1985	282	37%	20%	43%
Vicini et al.	IJROBP 2004	441	36%	55%	9%
Vaidya et al.	BJC 1996	30	37%	50%	13%

*MCF: Multicentric tumour foci; pts: patients; Tumor: tumour.



Recurrence patterns

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Ipsilateral breast tumour recurrence (IBTR) in the tumour bed and at margins has been found to be as high as 50 -60% of all local recurrences

	Tumour Bed/Scar	In same quadrant	Diffuse throughout
EORTC Trial	56%	29%	27%
NSABP -06	95%		5%

Boost target delineation

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- Imaging modalities- mammography, USG, CT, MRI
- Useful aids in CT based contouring- clips, external scar, internal scar tissue, seroma
- Immediately after surgery- cavity contains seroma + Air
- Need to give suitable margin to it(1-2 cm) to generate final CTV

Comparison of various techniques of boost delineation

Technique	Advantages	Disadvantages
Surgical Scar	<ol style="list-style-type: none"> 1. Feasible. 2. No additional costs. 3. Non invasive. 	<ol style="list-style-type: none"> 1. Depends on placement of scar. 2. Highly subjective.
Clips & Fluoroscopy	<ol style="list-style-type: none"> 1. Feasible. 2. Inexpensive. 	<ol style="list-style-type: none"> 1. Mobility of clips in the lumpectomy cavity. 2. Variable position and numbers.
Ultrasonography	<ol style="list-style-type: none"> 1. Can be used intra as well as post-operatively. 2. Images are compatible with RT planning systems. 3. Is relatively inexpensive. 4. Non-invasive. 5. Reproducible images. 6. Tumour bed is directly visualised. 	<ol style="list-style-type: none"> 2. Definition hampered by healing process. 3. Poor definition 6–8 weeks post-operatively.
Clips & Computerised Tomography	<ol style="list-style-type: none"> 1. Accuracy same as that of clips and fluoroscopy. 2. Can be planned in treatment position. 3. Excellent definition of breast tissues. 	<ol style="list-style-type: none"> 1. Glandular tissues not well defined. 2. Clips necessary for definition. 3. Varies with window settings.
Magnetic resonance imaging	<ol style="list-style-type: none"> 1. Accurate localisation of target volume. 2. Accurate localisation of organs at risk. 	<ol style="list-style-type: none"> 1. Costly, limited resources. 2. Image distortion during co- registration with TPS. 3. Difficulty in scanning in treatment position.

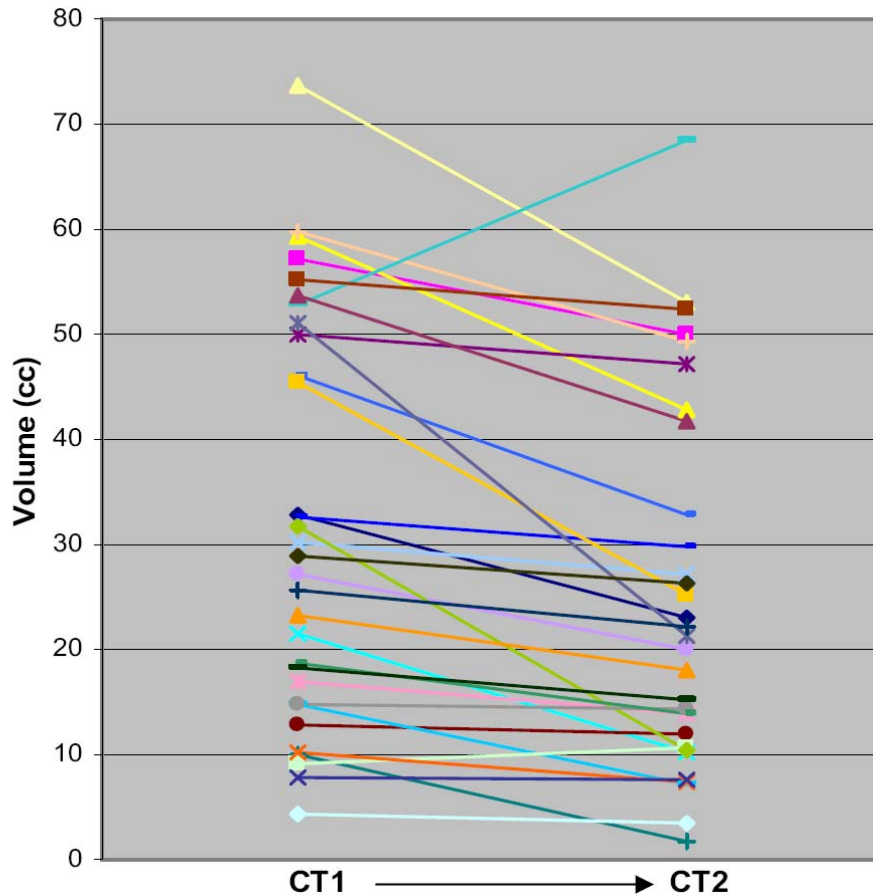
Scar versus clips

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Study	N	Margin given to scar	Incomplete coverage of clips
Denham et al, CI oncol 1991	27	1.5-2 cm	42%
Bedwinek et al, IJROBP, 1993	35	2-3 cm	54%
Machatay et al, IJROBP 1994	316	3-4 cm	10-36%

Effect of Time!

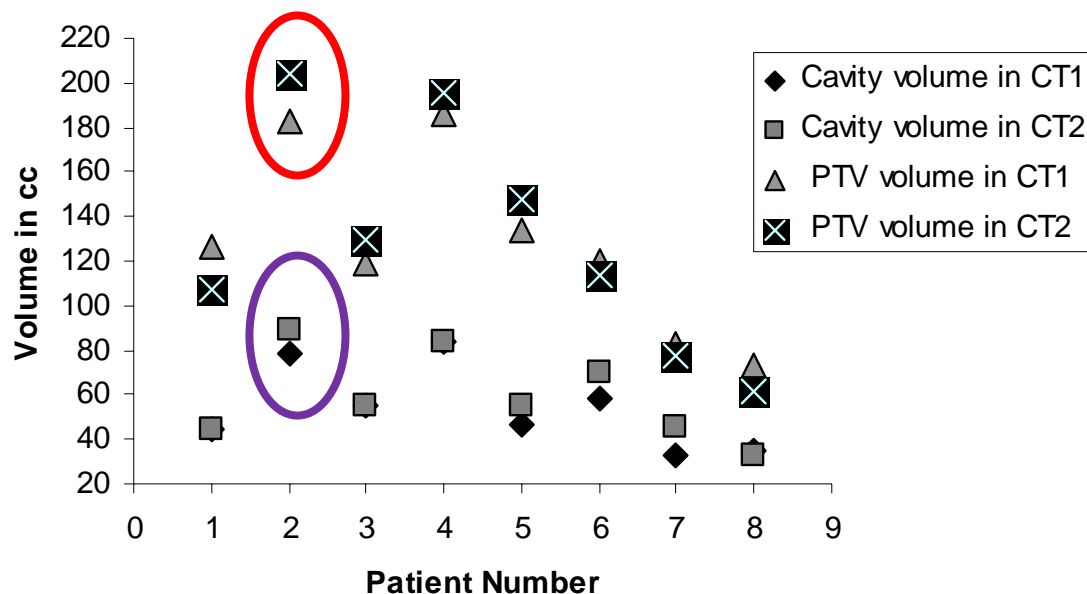
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Of 31 excision cavities,
29 (93.5%)
were reduced in volume.
The average change was
22.5%, p 0.0001

Effect of Time!

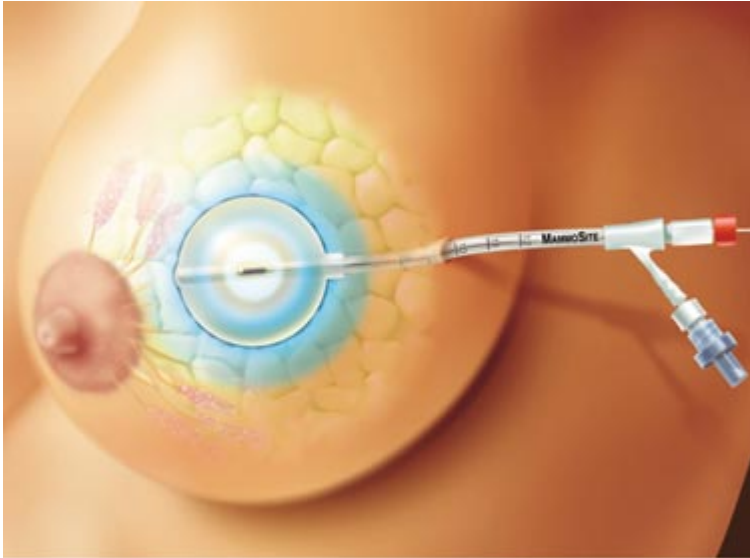
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*R Upreti et al , unpublished data,
TMH*

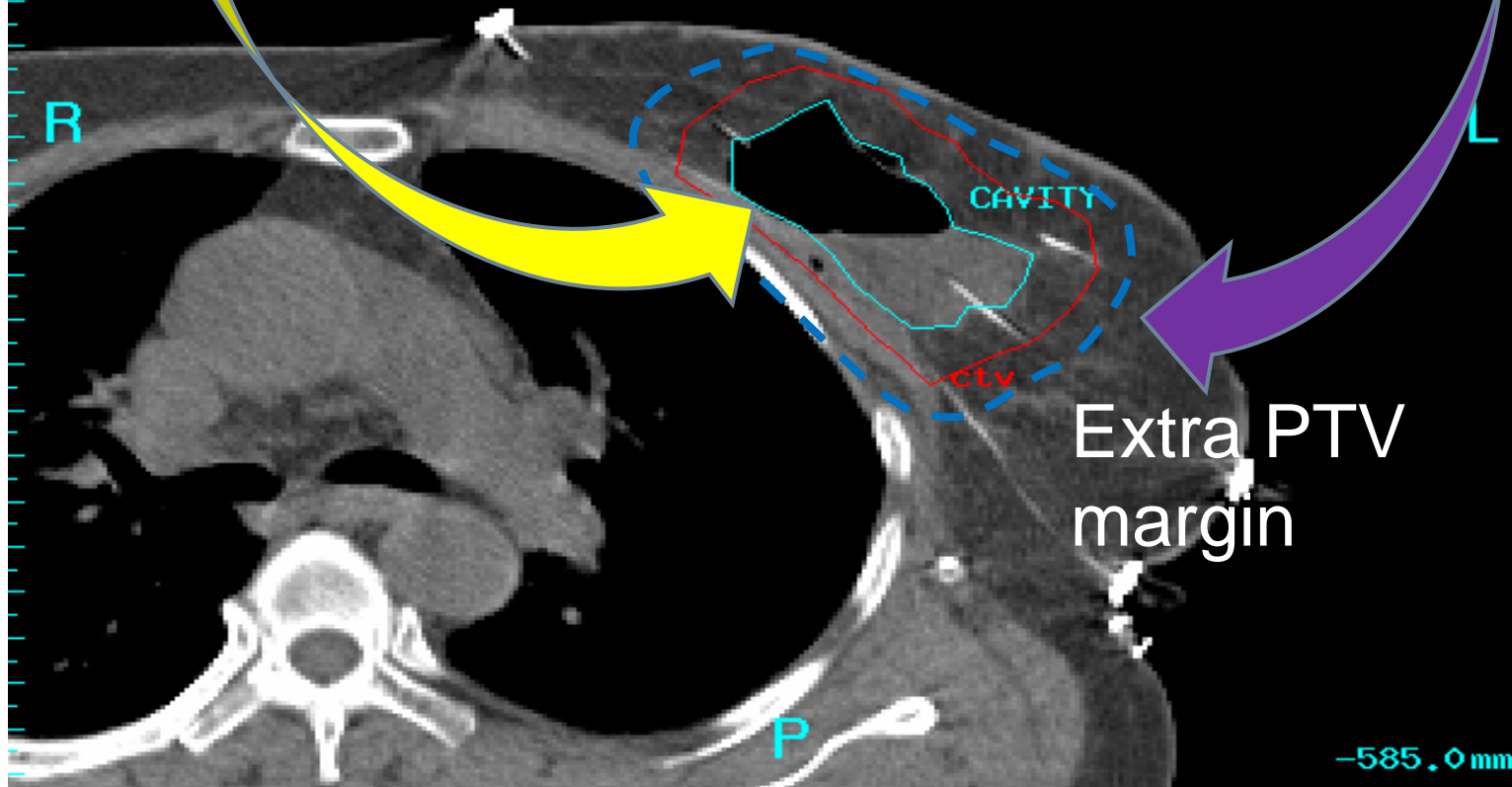
Breast Boost irradiation techniques

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Brachytherapy target vs XRT target for cavity

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Boost target -other challenges

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- Patient having received neoadjuvant chemotherapy
- Proximity of the cavity to the skin and chest wall
- Oncoplastic surgery

Conclusions

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- Proper contouring of the breast is critical for 3DCRT and Forward Planning IMRT plans
- Proper delineation of boost target/cavity volume(using all appropriate modalities) is critical
- Use correct window width and level

Conclusions

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- Need to be aware of uncertainties in contouring aids
- Beware of geographical misses, especially in the present precision era
- Emerging role of 4D CT and gated treatment planning for decreasing dose to OAR's



Thank you