2D Radiotherapy Planning in Ca Breast

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Position of the Patient

Supine Position
Both arms elevated above head
More comfortable
Position of the Patient
Asymmetrical

Arm on involved side elevated above the head and face turned away from involved side
Special Precautions & Difficulties

A small misalignment of the patient on the treatment couch will have the same effect as if the couch were angled.

**Tilt**

Tattoos are put over anterior surface so that patient remains straight throughout the treatment.
Two Lateral Tattoos
REGIONS TO BE TREATED AFTER MRM

- Supraclavicula
- Axilla
- Chest wall
- Internal Mammary
Difficulties in RT Delivery
1. Matching of the adjacent Radiation Fields

- Supraclavicular
- Axilla: Direct field
- Chest wall: Tangential
- Internal Mammary

Direct field or with tangential
Divergent Nature of the Radiation Beam

200 cGy

400 cGy
Hot spot

200 cGy
Divergent Nature of the Radiation Beam

200 cGy

Cold Spot

200 cGy
2. Sloping Chest Wall
3. Underlying Heart and Lung
Matching of the Adjacent radiation fields
• Matching of S/C and Tangent fields

Two Divergence

1. Divergence from Supra clavicular field

2. Divergence from Tangential field
Divergence from Supra Clavicular Field
Divergence from Tangential

Supraclavicular Field

Hot Spot
1. Half Beam Block
   - Set the central axis of beam at matching line i.e. at junction
   - Open the length double i.e. if length is 6cm open 12 cm
   - Block the lower half of the length.
2. Asymmetrical Jaws

- Set the central axis of the beam at junction.
- Only open the upper jaw.
3. Gantry Rotation:

- First calculate the angle of divergence from s/c field

\[
\tan \theta = \frac{\text{Half field length}}{\text{SSD}}
\]

- Move couch 90°
- Rotate gantry 6° towards patient feet

Solution Divergence from S/C
Couch & Gantry Rotation

Rotate towards patient’s feet
Solution Divergence from Tangent

Asymmetrical Jaws

- Set the center of the beam at junction
- Open only lower jaw
Solution Divergence from Tangent

**Couch Rotation**

(a) Calculate the angle of divergence

\[
\frac{\text{Half field length}}{\text{SSD}}
\]

(b) Set the tangential field as usual

(b) Give couch twist 6° away from gantry in both MT and LT

![Diagram showing couch rotation and divergence angles](image)
Couch Rotation: Away from the Gantry

6°
Couch Rotation: Away from the Gantry
Matching between Internal Mammary and Tangential fields

- Supraclavicular
- Direct field
- Axilla  Direct field
- Chest wall  Tangential
- Internal Mammary
- Direct field or with tangential
Cold area

Both fields are matched at surface.

WHY?

Because both fields are angled in different direction
Angled the IM field to make it parallel to the tangential field.

Problem

More lung will be irradiated by IM field.

Solution

Treat IM field with electron beam
Solution

Treat IM field with electron beam
Sloping Chest Wall
Problems

More lung comes in Tang field caudally

If field is set to reduce the lung caudally, then chest wall cranially will be missed
Solution 1

Sloping Chest wall

Chest wall and anterior border of the lung is parallel to the couch
Solution 2 → If Breast Board not available

Problem→ Tangential field will encroach the s/c field resulting into hot spot

Solution→ shield the corner of Tangential field by making individualized blocks

Give collimator angle to make field parallel to the lung
Solution 3 → If Breast Board not available

Shaped Blocks to be made individually parallel to the chest wall to shield the lung
Underlying Heart and Lung
Divergence in Lung from Tangential field

Medial tangential

Lateral Tangential

More Lung Tissue is Irradiated
Solution 1

Breast Cone

- Set the center at the entry point
- Open the field
- Use breast cone to shield the inner half
Solution 2

Asymmetrical Jaws

- Set the center at the entry point
- Open only one jaw
- Central axis will pass through lung as straight line
Solution 3
By Rotating gantry head upward

Calculate the angle of divergence by

\[ \tan \theta = \frac{\text{Half field width}}{\text{SSD}} \]
Posterior edge of the beam becomes co-planer after gantry rotation on transverse section
Number of fields

• If treating chest wall and all regional nodes then there are two techniques
  • Two fields Techniques
  • Three fields Techniques
Two Field Technique

1. S/C and Axilla by single direct field
2. Internal mammary and chest wall together by tang field
Two Field Techniques

- More lung will be irradiated
- Opposite breast receive higher dose of radiation
- Portion of the heart will also be irradiated
Deep Tangential or Extended Partial Tangential field

- Only LN of upper 3 intercostal space are involved

- The upper part of chest tangential field is extended medially to cover the internal mammary nodes of upper three intercostal space.
Three Fields Technique

1. S/C + Axilla by direct field
2. IM by direct field
3. Chest wall by Tangential field
Field Boundaries
Supraclavicular RT

• **Indication:-**
  • 4 or > 4 axillary nodes positive
  • T3 or T4 tumors
  • Inadequate axillary dissection
  • No axillary dissection
Upper border of Tangential field

Thyrocricoid groove

Lateral border of the cricoid process

Sternocleidomastoid Muscle

Along medial border of sternocleidomastoid muscle

Portal Anterior Direct

Prescription Depth 3cm from skin

Beam Photon 4 to 6 Mev

OR cobalt 60
RT to Axilla

• Indication
  • Inadequate Axillary Dissection ( < 10 )
  • No axillary dissection in presence of positive sentinel node.
  • Extensive extra capsular extension
  • More than 75% nodes are positive ( eg 15/20)
Lateral border is extended more laterally to include the axilla.

Humeral head is shielded.
Supraclavicular and Axilla

Beams eye view and projected field over skin
Posterior Axillary field

SC 50 Gy

3 cm

Mid Plain <50 Gy

Post Axillary Field
Upper Border along the spine of the scapula

Lateral border should match with lat border of ant axillary field with shielding of humeral head

Medial border along the convex lateral wall of the bony thorax cage with 1 to 1.5 cm of lung

Inferior border should match the lower border of Ant axillary field
Dose from Posterior field

• Calculate the contribution at mid plane by ant axillary + S/C fields
• Rest of the dose to be given from post field to make total dose 50Gy
• For example if the contribution from ant field is 35 Gy, give 15 Gy from post field.
• Indications:
  – Extensive axillary disease
  – Central or medial tumor > 5 cm size
Internal Mammary Nodes

Internal mammary nodes are in close proximity to the internal mammary vessels which are located approximately 3-4 cm lateral to mid line and 3-4 cm deep to the surface.
Field Boundaries

At inferior border of S/C field

The width of the field is usually 5 cm

At 4th costal cartilage

Base of xiphoid

Mid line

Prescription Depth

4 Cm

Radiation

Photon OR Electron
Chest wall Irradiation

• By two tangential fields
  • Medial Tangential
  • Lateral Tangential
Sternal Head of the Clavicle
2 cm below inframammary fold
Mid axillary line

2 cm contra lateral side
if IM node to be included in tang field
Mid line

2 cm below inframammary fold
Lateral border of internal mammary

Energy
Cobalt 60
4 to 6 mv photon
Parameter for Tangent Fields

- Length
- Width
- Gantry Angle

Length of the field
MT Angle

Ant

Post

Rt

Lt

Upper border should be 1 cm in Air

Lung not more than 2 cm

LT Angle

Width
Tangent Portals
Dose distribution with two tangential fields

Note the higher doses at surface and medial and lateral deep breast tissue

Prescription

50 Gy/25 F/5W
Reasons for Hot spots
Solution:-
Use Wedge with thick end upward which act as compensator for missing tissues

It removes hot spots anteriorly.
The medial and lateral hot spots will still remain
Radiographic Parameter on Virtual simulation

Central Lung Distance (CLD): width of the lung at central axis

Lung Length: Vertical lung distance included in the radiation portal.

Maximum Heart Distance (MHD): maximum width of the heart in the tangent field.

Maximum Heart Length (MHL): Maximum length of the heart in the tangent field.
Radiotherapy Techniques in Ca Breast

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