

EXTERNAL BEAM RADIATION THERAPY (EBRT)

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INTRODUCTION

- EBRT: Type of radiation therapy that delivers the radiation beams from outside of the body to the target (tumor) in the body.



SIEMENS PRIMUS Linear Accelerator



SIEMENS MEVATRON Linear Accelerator

TYPE OF RADIATION THERAPY TREATMENT

Radical

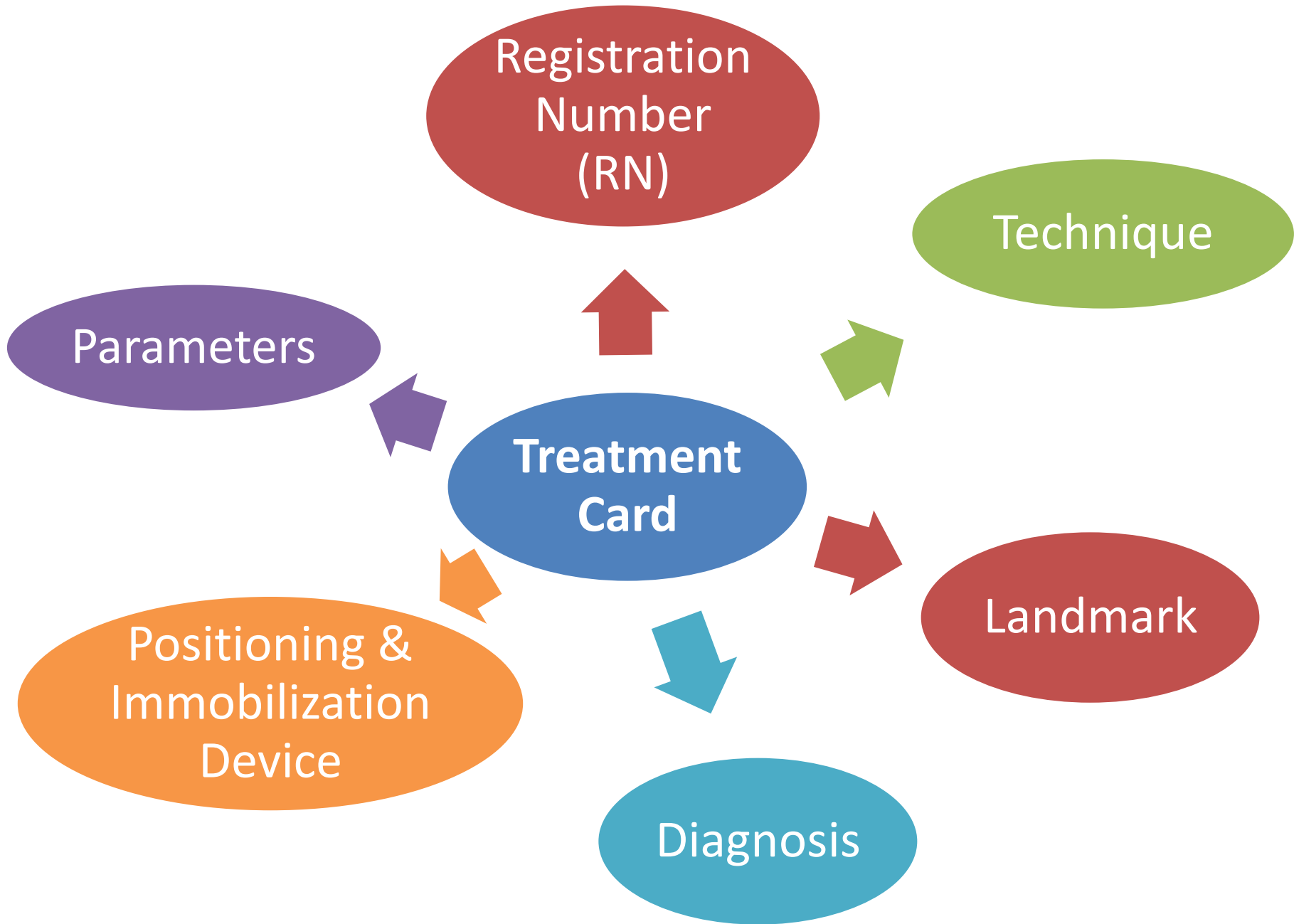
- Curative radiation treatment
- To get rid of cancer cells.

Adjuvant

- Radiation therapy given after the primary treatment
- To help decrease the risk of the cancer recurring
- May include chemotherapy, radiation therapy, hormone therapy, targeted therapy, or biological therapy.

Palliative

- Not to cure the cancer
- To relieve cancer symptoms
- To improve quality of life
- Can reduce size of the tumour.

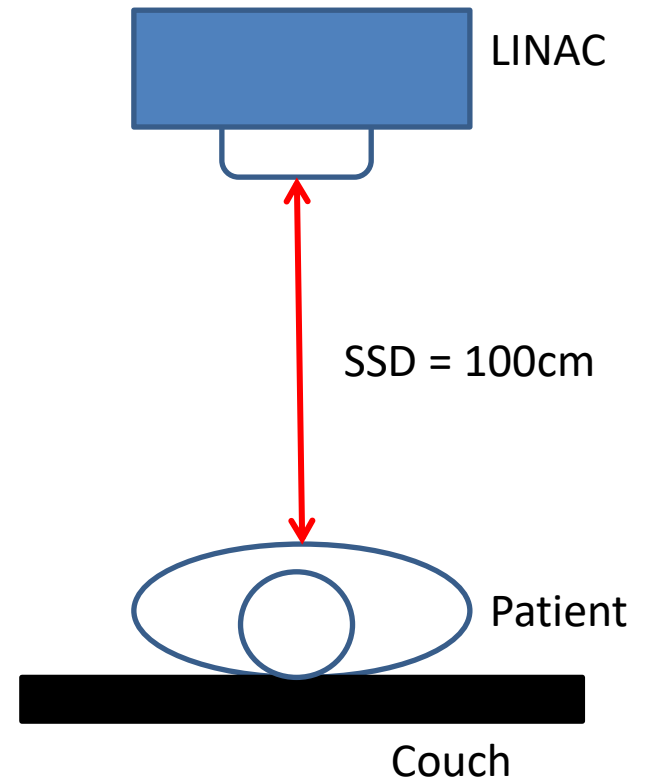


TECHNIQUE IN RADIOTHERAPY

- 1. Source-Skin Distance (SSD)
Technique*
- 2. Source-Axis Distance (SAD)
Technique*

1. SSD Technique

- The patient's skin surface is placed at the isocentric axis (isocenter) of the LINAC.
- The distance from patient's skin to the source is equal to the SAD of the machine.
- Separation: < 20 cm
- When SAD of the unit = 100cm, SSD = 100cm.



SSD = The distance from the source to skin surface.

SAD = The distance from the source to isocenter. It also known as source-axis distance (SAD).

2. SAD Technique (Isocentric)

- The isocentric axis of LINAC is placed at a point within patient body.
- The SSD will be less than the SAD.
- In case: separation > 20 cm
- A **PIN** is a reference point on the skin surface that related to the position of the isocenter.
- PIN: 10 cm & SAD = 100cm
- SSD = $(100-10)$ cm = 90 cm

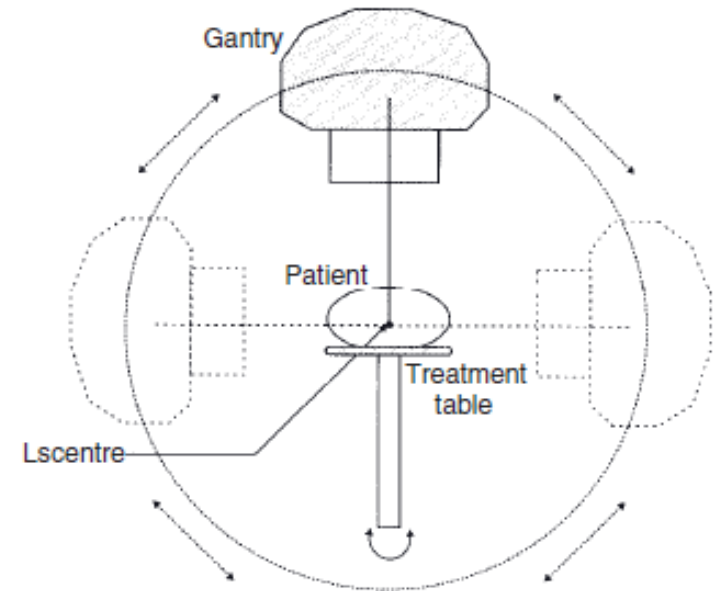


Figure 11.2 Figure of isocentric mounting.

Case 1: Head and neck

| Patient RN: B 498998 | | | | |
|-----------------------|-----------------------|---|-----------------|-----------------|
| Date: 28/03/2013 | | Diagnosis: NASOPHARAGEAL CANCER T ₃ N _{3b} M ₀ | | |
| Field Size No. | 1 | 2 | 3 | 4 |
| Name of Field Size | Right Lateral Face | Left Lateral Face | Anterior Neck | Posterior Neck |
| Field Size | 11 (y) X 9.5(x) | 11 (y) X 9.5(x) | 13.3(y) X 21(x) | 13.3(y) X 21(x) |
| Gantry Angle | 270° | 90° | 0° | 180° |
| SSD/ SAD | SSD: 100 cm | SSD: 100 cm | SSD: 100 cm | SSD: 100 cm |
| Collimator Angle | 0° | 0° | 0° | 0° |

Treatment Procedures

- Prepare set-up:



- Instruct patient to lay supine with back-support SR1 + SR2 and hands on side



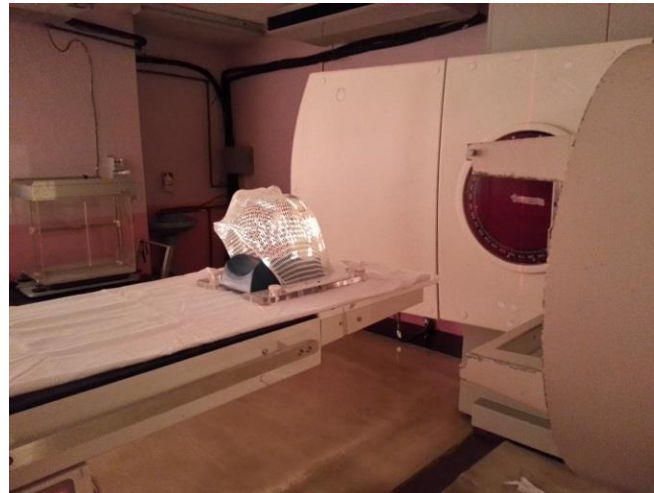
- Alignment the vertical and horizontal line according to BDS markers.



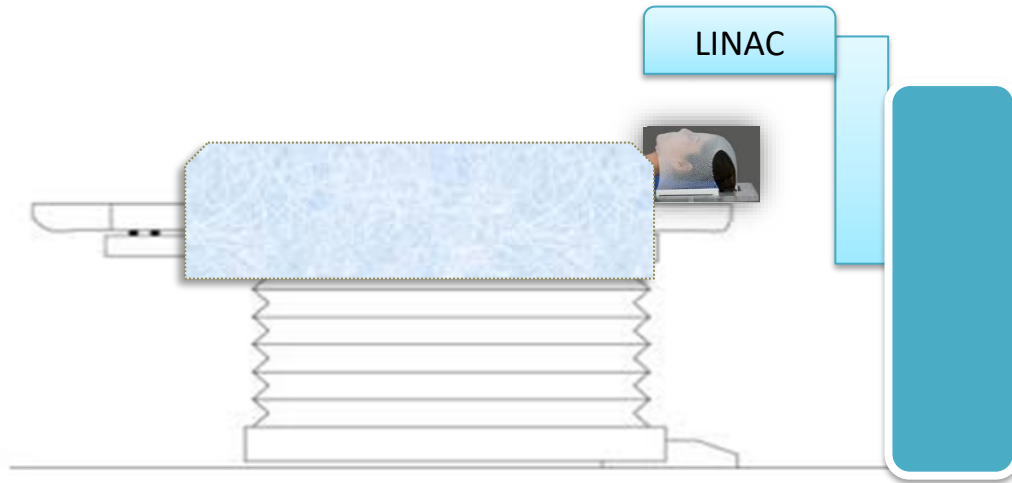
- First beam projection (Right lateral face). Turn gantry 270°.



- Second beam projection (Left lateral face). Turn gantry 90°.



- Third beam projection (Anterior neck). Gantry at 0° .



- Forth beam projection (Posterior neck). Gantry at 180° .



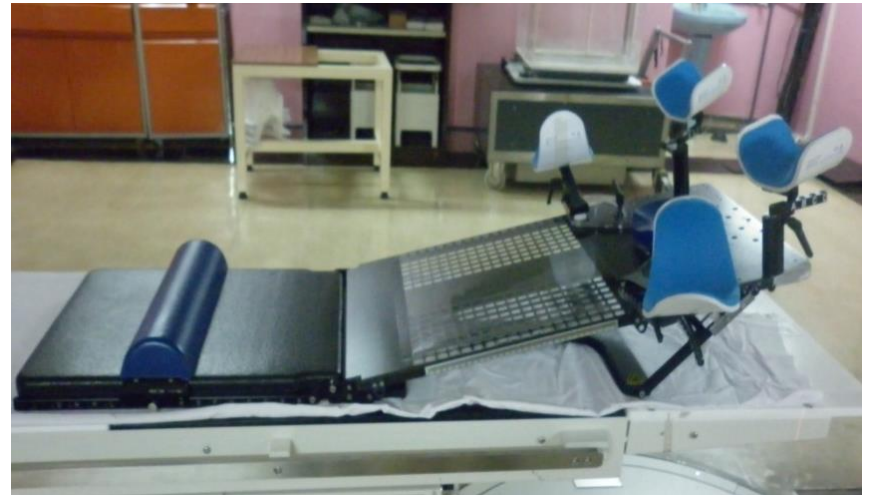
Case 2 : Breast

| | | |
|---|--|-------------------------|
| Patient RN : B511471 | | |
| Date : 15 APR 2013 | Diagnosis: Right Breast Cancer, T ₂ N ₁ M ₀ | |
| Purpose of treatment: Adjuvant-Post operative irradiation | | |
| No. of Field Size | 1 | 2 |
| Name of Field Size | Right Lateral Tangential | Right Medial Tangential |
| Field Size | 5.5(y) X 16(x) | 5.5(y) X 16(x) |
| Gantry angle | 239 ⁰ | 63 ⁰ |
| Collimator angle | 90 ⁰ | 270 ⁰ |
| SAD/SSD | SAD | |
| Pinning | 3.1cm | |

Immobilization tools.

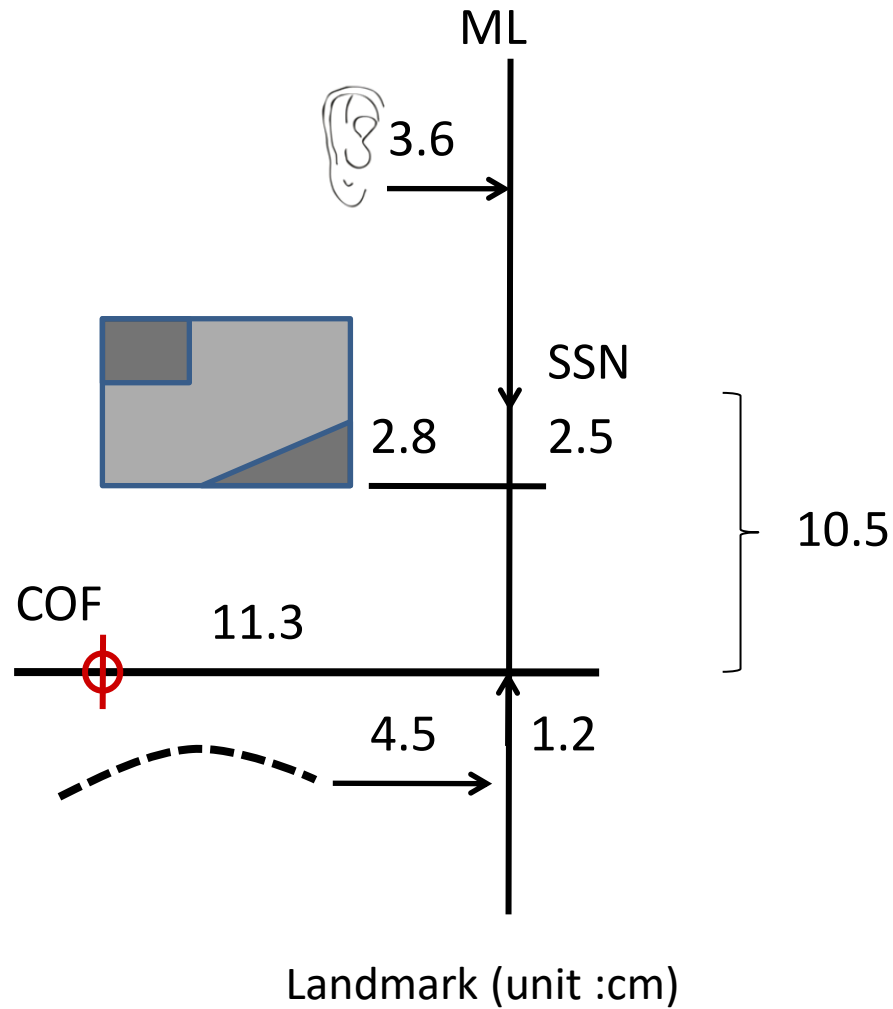
-use breastboard;

- Breastboard angle (θ°) : 2
- Hip support position : E
- Head position : 2
- Arm support : 40° , high 1, lateral 'A'



Breastboard

Patient positioning



Procedure

- Prepare set up.
- Confirmation of patient ID
- Patient positioning
- Irradiation



239° (Rt Lat. Tangential)



63°(Rt Med. Tangential)

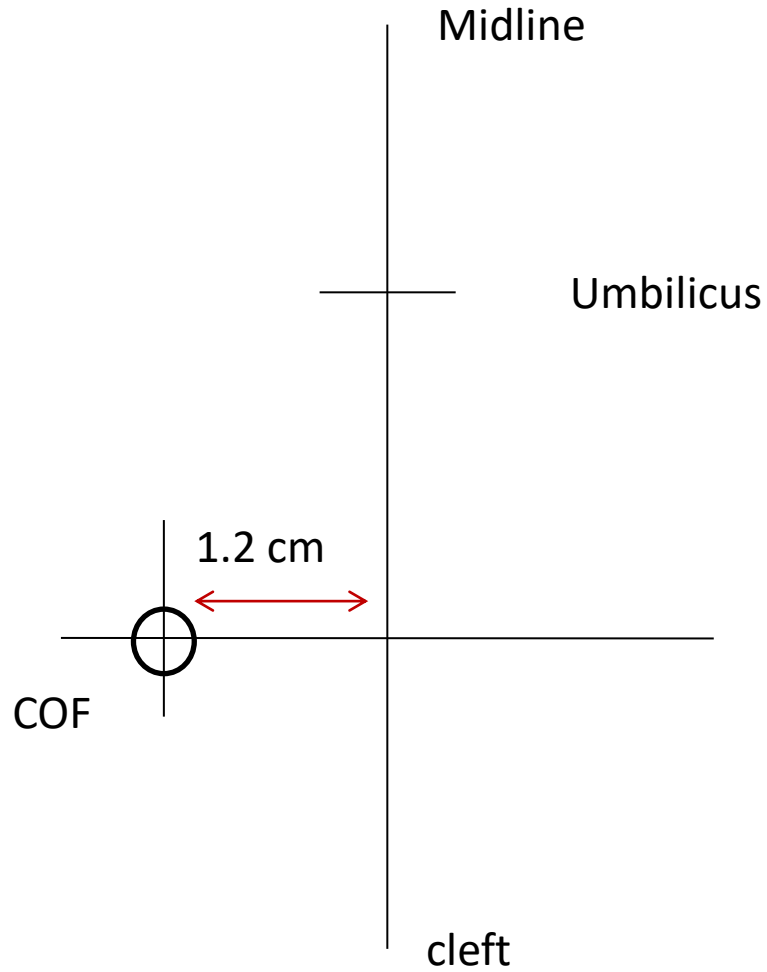
Case 3: Cervical Cancer

| | | | | |
|-----------------------------|-----------------|----------------------------|----------------------|---------------------|
| Patient RN: B 511033 | | | | |
| Date: 26/02/2013 | | Diagnosis: Cervical Cancer | | |
| Field Size No. | 1 | 2 | 3 | 4 |
| Name of Field Size | Anterior pelvis | Posterior pelvis | Right lateral pelvis | Left lateral pelvis |
| Field Size | 16(y) X 16(x) | 16(y) X 16(x) | 16(y) X 12(x) | 16(y) X 12(x) |
| Gantry Angle | 0° | 180° | 270° | 90° |
| SSD/ SAD | SAD: 90.4 cm | SAD: 90.4 cm | SAD: 90.4 cm | SAD: 90.4 cm |
| Collimator Angle | 0 | 0 | 0 | 0 |

- Patient Positioning and Immobilization Tools

- ✓ Supine
- ✓ Pillow under head
- ✓ Hands on chest

- Landmark



Field: Anterior Pelvis



Field: Posterior Pelvis



Field: Right Lateral Pelvis



Case 4: Skin

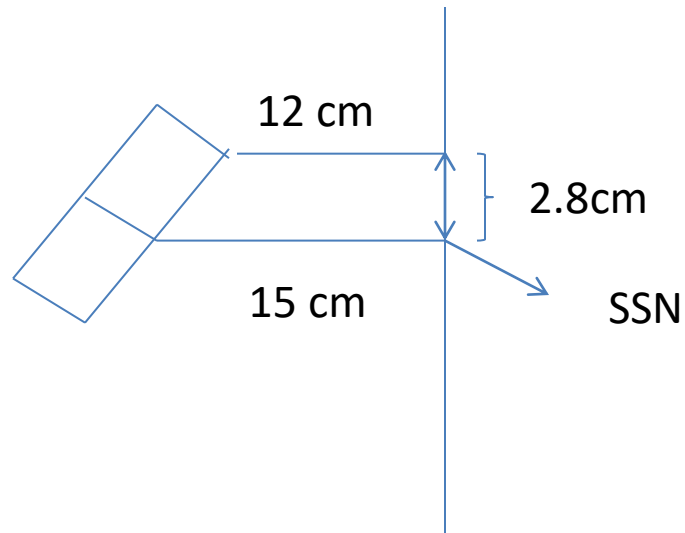
| Patient RN: B 013026 | | | | |
|-----------------------|----------------------|---|---|---|
| Date: 11/03/2013 | | Diagnosis: Skin Cancer (R) shoulder arc | | |
| Field Size No. | 1 | 2 | 3 | 4 |
| Name of Field Size | Ant. Rt. Shoulder | Post. Rt. Shoulder | | |
| Field Size | 20 (y) X 9(x) | 20 (y) X 9(x) | | |
| Gantry Angle | 0° | 180° | | |
| SSD/ SAD | SSD: 100 cm | SSD: 100 cm | | |
| Collimator Angle | 308.2° | 51.8° | | |

Pt. Positioning and Immobilization Tools

- ✓ Patient supine
- ✓ HR 'A'
- ✓ SR '2' under Rt. Shoulder
- ✓ Rt. Hand Akimbo
- ✓ Wing board



Landmarks





Wing board

Example of patient positioning for skin cancer



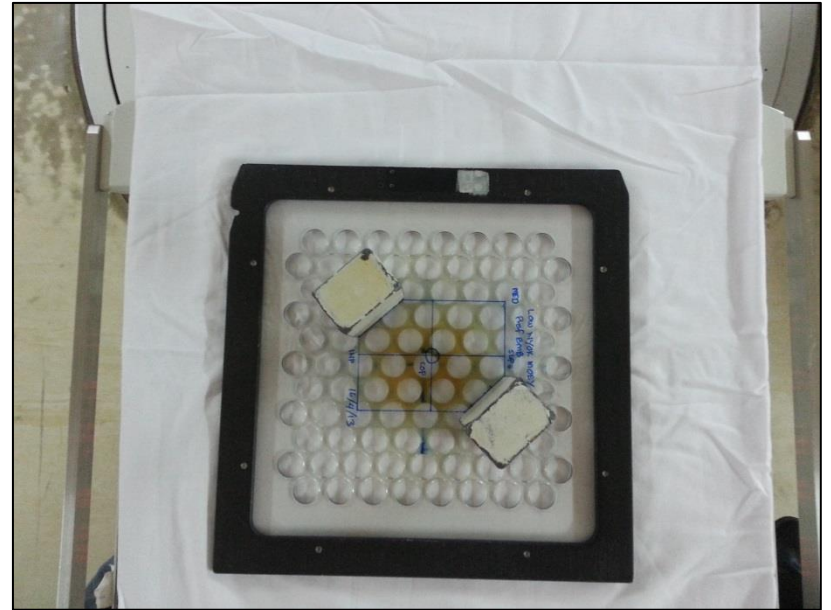
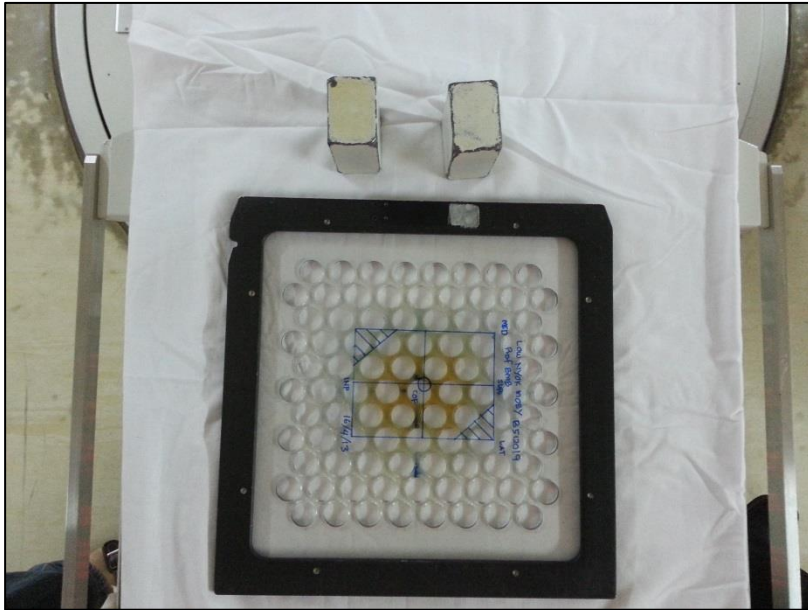
Beam Modification Devices

1. Wedges

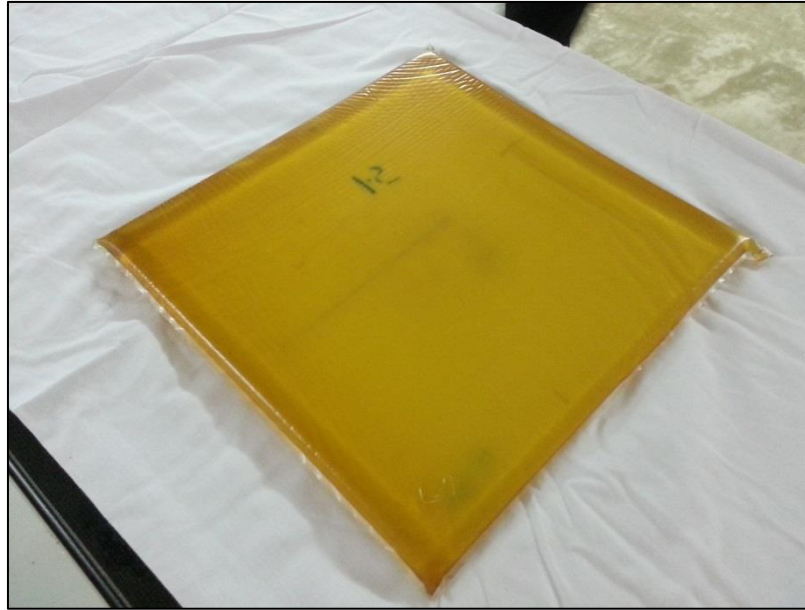


- Solid triangular blocks of metal that are inserted into the head of the gantry to manipulate the radiation beam and accommodate for changes in contour and density.
- 15° , 30° , 45° and 60°

2. Tray and Lead Block



3. Bolus



- A solid, homogeneous, tissue-equivalent gel with a density of 1.03g/c.
- A tissue-equivalent material used to change the surface deposition of a radiation beam.
- Bolus is placed in contact with the skin to achieve one or both of the following: increase the surface dose and/or compensate for missing tissue.

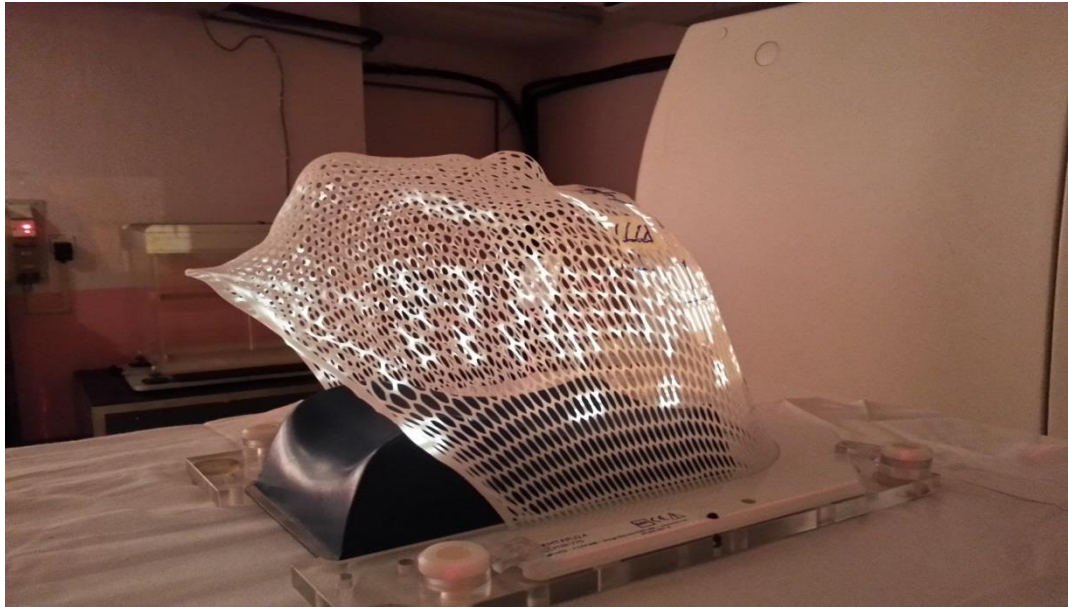
Patient Immobilization/ Support Devices

4. Head and Shoulder Rest



- For patient comfortable and stability
- Both HR and SR are usually used together
- Different HR and SR with different thickness

5. Beam Direct Shell



- Made of thermoplastic shell
- Immobilization by preventing chin-drop and shoulder rotation
- The point of target is drawn and marked on the BDS - positioning

6. Breast board

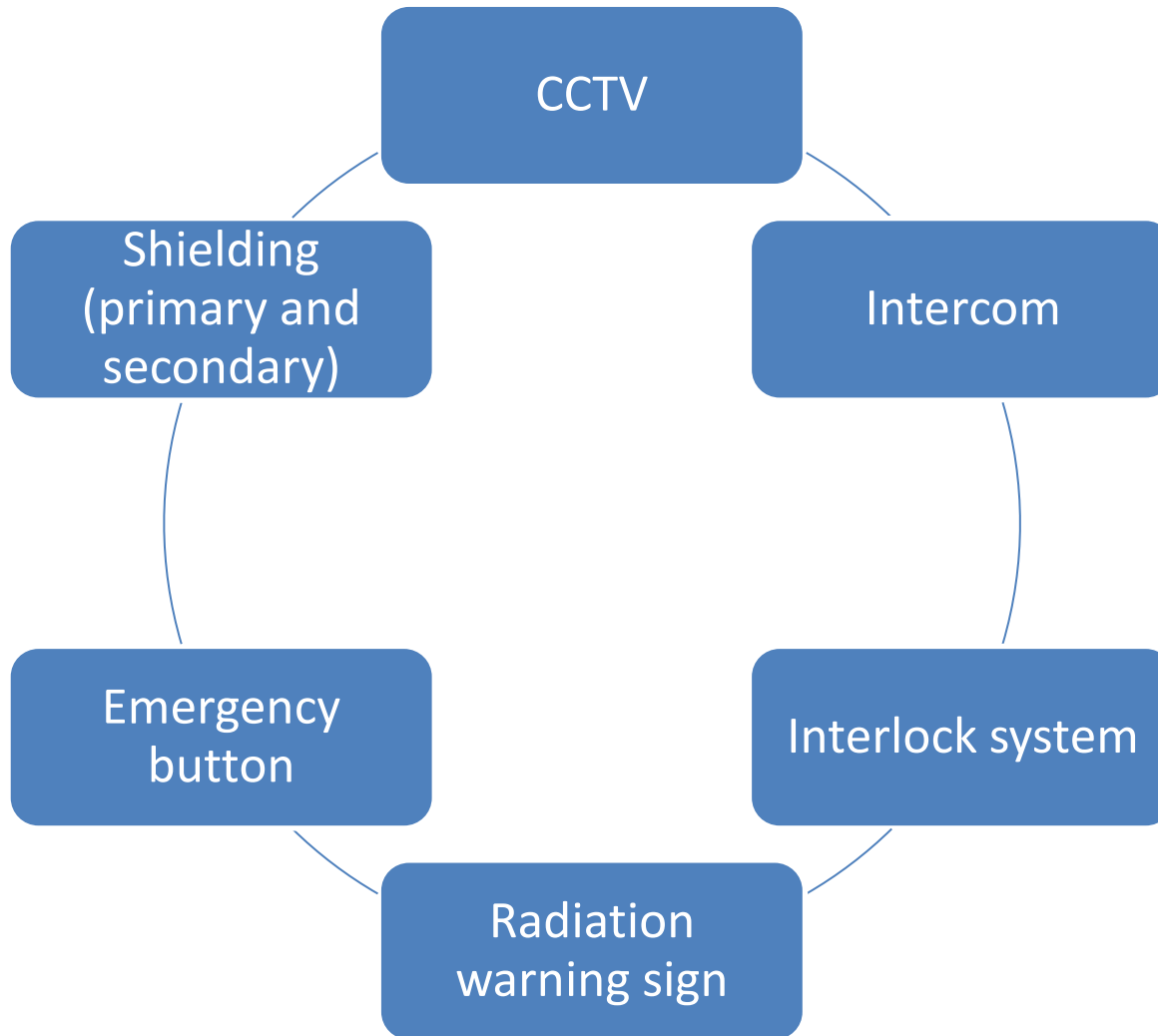


- Support and immobilize patients for breast carcinoma
- Has an array of hand and head support positions of bi-axial arm and wrist support system, round head cup
- Made of carbon fiber - low attenuation
- The system can be adjusted according to patient comfort

Patient Care

1. The continuum of care is essential in the treatment of cancer from diagnosis through to follow up.
 2. Provide the highest possible standard of care for patients during treatment.
- ✓ Explain the treatment procedures and time taken to patient
 - ✓ Remind patient to not apply anything on the treatment surface and avoid rubbing.
 - ✓ After the treatment, patient is informed certain side effects they may experience.
 - ✓ Make sure to drink plenty of water.

Radiation Safety and Protection



CCTV

door

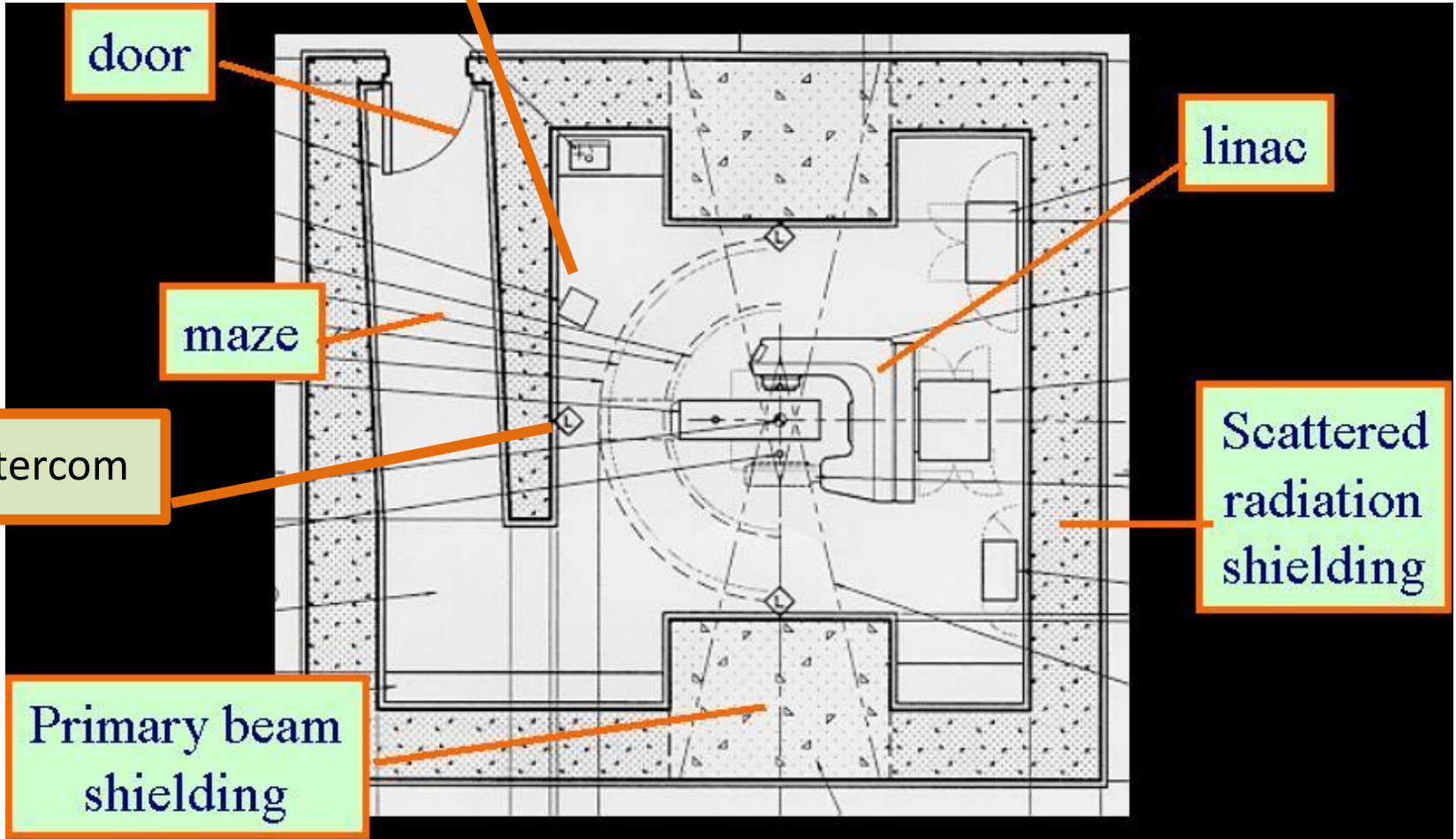
maze

intercom

Primary beam
shielding

linac

Scattered
radiation
shielding



CONCLUSION

- ✓ The newer 3-dimensional conformal radiation therapy (3D-CRT) and intensity modulated radiation (IMRT).
- ✓ It's highly likely that patients will have some side effects - radiotherapy temporarily damages some of the healthy cells - cancerous ones.
- ✓ Prevents local recurrence of cancer – the recurrence rate determines the success of radiotherapy treatment

References

- ✓ Cancer Treatment Guide. Retrieved from: <http://www.prostate-cancer.com/radiation/cancer-treatments/radiation-cancer-treatments.html>.
- ✓ Hermitage Medical Clinic, Patient Care. Retrieved from: <http://www.hermitageclinic.ie/services-specialities/clinical-departments/radiotherapy-department/patient-care/>.