

What is Radiation Therapy?

- Uses high-powered beams of energy, such as X-rays and Protons to kill cancer cells (Mayo Foundation for Medical Education and Research, 2022b, p. 6)
- Is a local treatment that can be used alone or with other treatment modalities
- It can be curative, palliative, or tumor control
- Benefits- better cosmetic results, and preservation of function (Washington, Leaver, & Trad, 2021, p. 10)

Breast Cancer Facts

- Most common diagnosed malignancy in the world for women
- The second leading cause of cancer related deaths worldwide after lung
- In 2022 it was estimated 280,000 new cases and 40,000 deaths will occur in the U.S. (Sakellis & Jacene, 2022, p. 542)
- Less than 1% of diagnosed breast cancer is in men
- 1 in 8 women will be diagnosed with breast cancer in their lifetime
- Since 2004, breast cancer rates in the U.S. rise 0.3 % per year
- Diagnosis is rare before age 40
- Is a heterogeneous disease (Houghton & Hankinson, 2021, p. 822)

Types of Breast Cancer

Inflammatory Breast Cancer (IBC)

- Rare but distinct subtype of locally advanced breast cancer occurring in relatively young women
- Aggressive in nature and poor prognosis
- Characterized by diffuse sheets and cords of tumor, dermal lymphatic invasion, breast skin edema and, erythema

- 1-5% of breast cancer cases in the U.S., but responsible for 10% of breast cancer deaths

Lobular carcinoma (LCIS)

- 5%-15% of breast cancers diagnoses

Ductal Carcinoma (DCIS) or invasive ductal

- Most common
- 70-80% of breast cancer diagnoses (Sakellis & Jacene, 2022, p. 543)

Hormone receptivity (HER-2)

- presence or absence of estrogen and progesterone receptor expression in malignancy

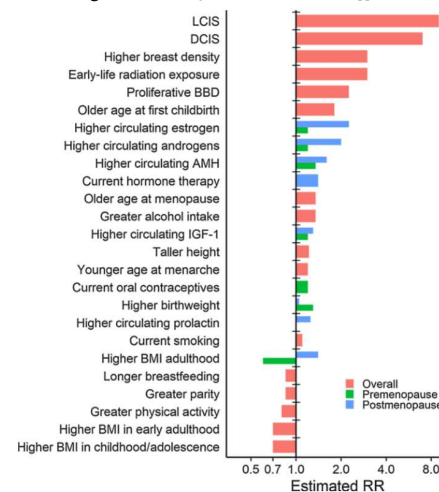
- When this type does not metastasize, it is treatable.

Triple negative breast cancer

- 15% of women with breast cancer
- Malignancies that do not express hormone receptivity
- More common in younger, Hispanic, and/or black women
- More likely to be diagnosed at a later stage.
- Highest risk of relapse (Watkins, 2019, p. 14)

Breast Cancer Pathology and Risk Factors

- Breast cancer cells grow abnormally, and divide rapidly
- Risk rises with prolonged estrogen exposure
- Having a first degree relative with breast cancer increases the risk 2-3 times
- 10-15 % of breast cancers are hereditary
 - Gene BRCA 1 and BRCA 2
- Increase risk of breast cancer with:
 - Obesity or/and a BMI more than 33 kg/m²
 - Having your first child after the age of 30
 - Greater birthweight
 - Early menarche (before 13) and older menopause
 - Higher levels of estrogen, androgens, and prolactin's
 - Use of oral contraceptives
 - Eating processed meats
 - Exposure to secondhand smoke/ smoking and air pollution
 - Drinking alcohol (Houghton & Hankinson, 2021, pp. 825-831)



Graph shows the risk rate associated with factors and pathology. Pink is overall, green is premenopausal, and blue is post menopausal (Houghton & Hankinson, 2021, p. 832)

Signs and Symptoms

- A palpable breast mass is evident in about 30% of women with breast cancer (Watkins, 2019, p. 14)
- Irregularly shaped mass
- Speculated edges of mass
- Anatomical distortion
- Nipple discharge/ inversion
- Peeling, scaling, crusting, or flaking of breast tissue
- Redness (Washington, Leaver, & Trad, 2021, pp. 712-714)

Imaging/Simulation Setup

- Imaging plays a key role in diagnosis and staging of breast cancer
- Mammography, ultrasound, CT and MRI are all commonly used in the initial evaluation
- Pre-therapy simulations use a CT scan (Sakellis & Jacene, 2022, p. 542)
- Scan will determine dimensions of treatment field & help the planning of treatment
- Setup for breast can be supine or prone and undress from the waist up
- The patient will also receive tattoos or marks to indicate where the original scan images were taken and will be used for the planning process
- A bolus, bubble rap, and netting may be used to adjust patient anatomy and dose if needed
- CT SIM used by dosimetrist and physicist to plan treatments
- Treatments planned to avoid radiating vital organs

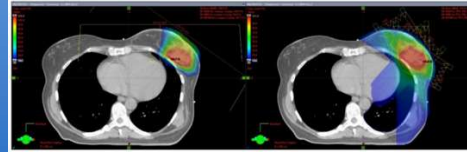


Image is showing a treatment plan made by the dosimetrists. The different colors are how much radiation is delivered in those areas with red being the most (Choi. et al. 2021, p. 4)

Diagnosis

- Screen for breast cancer with a breast exam, mammogram, or breast ultrasound
 - Once palpable mass is found the next steps are a diagnostic mammogram and ultrasound
 - Mammogram – is used for breast cancer screening. Diagnostic mammograms done when clinical suspicion from an abnormal screening
 - Breast ultrasound- used in conjunction with mammography when breast tissue is dense. May be used to determine if lump is solid mass or fluid filled cyst (Mayo Foundation for Medical Education and Research, 2022b, p. 2)
 - MRI may be used in specific circumstances such as dense breasts, viewing chest wall, and a history of breast cancer (Watkins, 2019, p. 15)
 - MRI used for presurgical planning of biopsy
- Biopsy types : Fine needle, Core needle, Excisional (Washington, Leaver, & Trad, 2021, p. 714)

Treatment

- Treatment 5 days a week for 4 to 7 weeks
- Boost treatment is a lower dose for women with a higher chance of reoccurrence (Watkins, 2019, p. 16)
- Patients are positioned exactly as sim treatment
- Line up to the marks and then make shifts according to the treatment plans
- Radiation may be delivered to the whole breast or just a portion for post lumpectomy, or the chest wall post mastectomy (Waks & Winer, 2019, p. 294)
- On treatment days, patients undress from the waist up, are positioned on the breast prone as in the SIM setup, make the appropriate shifts to be on isocenter. The first rotation of the gantry will be a CT scan to make sure anatomy is lined up completely with the dose plan. Treatment will begin
- In high- risk patients, systemic chemotherapy is recommended with radiation treatments (Moo, Sanford, Dang & Morrow, 2019, p. 10).
- Treatment may cause:
 - Acute skin changes, skin may become red, dry, and irritated after 30 Gy. Dry desquamation might occur after 40 Gy
 - Radiation induced fibrosis, which is a rare late event, directly related to dose
 - Fatigue
 - Lymphedema- impairment of lymph flow (Washington, Leaver, & Trad, 2021, p. 727)



Image of a treatment machine, and the black image is how the beam is cutting across the breast (Mayo Foundation for Medical Education and Research. 2022b. p. 1)

Conclusion

- Radiation therapy is essential in management of breast cancer after surgical removal of the tumor
- Radiation therapy after lumpectomy reduces recurrence by 54%
- Earlier detection yields better long-term outcomes
- Postmastectomy radiation therapy can reduce local recurrence by 73%
- Prevention – ask your doctor for a breast cancer screening, do self breast exams, drink in moderation, exercise, maintain healthy weight and diet, and limit postmenopausal hormone therapy (Mayo Foundation for Medical Education and Research, 2022a, p. 6)