



TECHNICAL MANUAL

A GUIDE FOR UNDERSTANDING BREAST CANCER

Dr. Coffman

HPRB 5410 W

Molly Gillahan, Aseel Mansour, Sam Chacko,
Kelly-Ann Baker

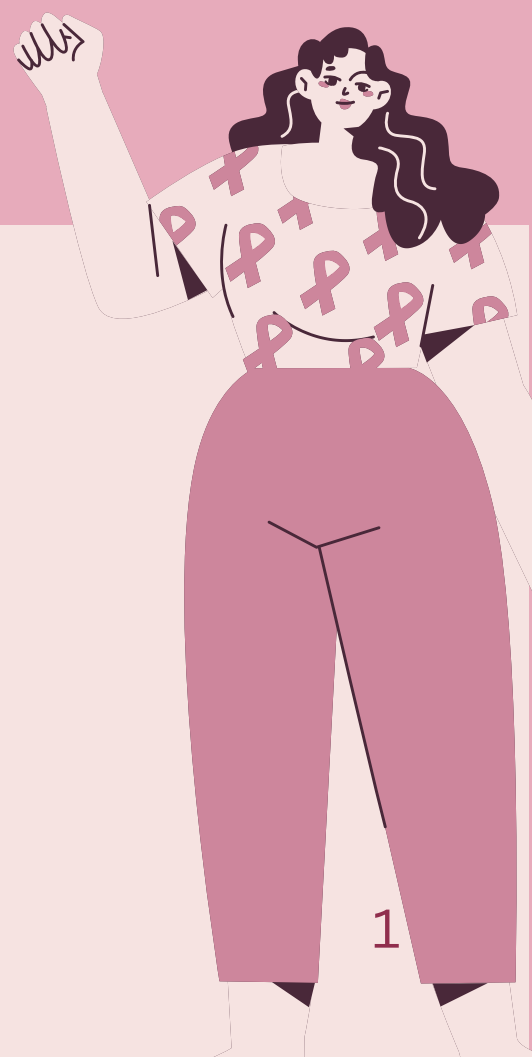


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Chapter 1: What is Breast Cancer?



What is Breast Cancer?

Breast Cancer is a type of cancer that starts in the breast when cells start to grow out of control and form lumps. It is one of the most common cancers among the United States as well as women. Symptoms include changes in breast shape, lump detection, skin changes, nipple discharge, and pain in the breast and chest. ¹



In the United States, about 2 million people are said to be diagnosed with breast cancer in a year. Among the 2 million, it's estimated that the number of women diagnosed is about 300,000, and then about 3,000 will be men. ¹

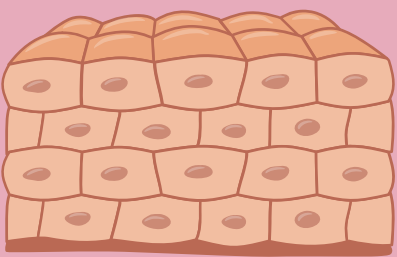


Anatomy of the Breast

Breasts are apart of both the female and male sexual anatomy. Apart of the female anatomy includes the nipple, Adipose tissue(fat), the areola, and glandular lobules.²

Adipose Tissue

Adipose tissue is a collection of fat cells. This tissue extends from the collar bone, underarm, and rib cage. As women age, adipose tissue continues to grow.³



Glandular Lobules

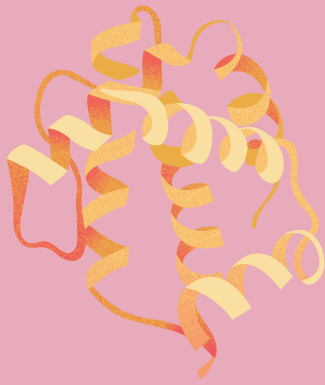
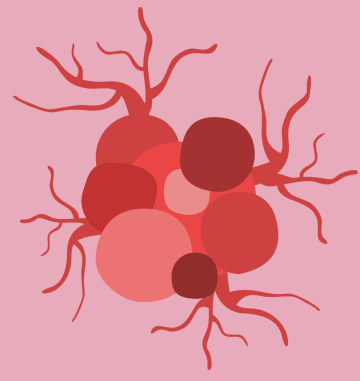
A healthy breast contains 12-20 section of glandular lobules. These lobes are responsible for producing milk for women who are nursing. These structures are typically where cancer starts growing.³



Types of Breast Cancer

DCIS

Ductal Carcinoma in Situ is what's considered a noninvasive type of breast cancer. This is where the cancer cells that form in the breast duct, stay there and don't spread throughout the breast tissue.⁴

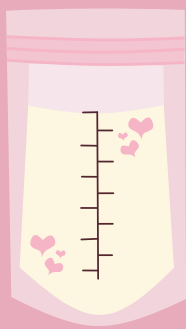


HER2- Positive

This type of breast cancer is considered invasive due to the excess amount of HER2 protein that is produced. This excess protein causes the cancer to grow more quickly.⁴

Invasive Ductal Carcinoma

This type of breast cancer that starts in a breast duct. It's the most common type of breast cancer.⁴



Invasive Lobular Carcinoma

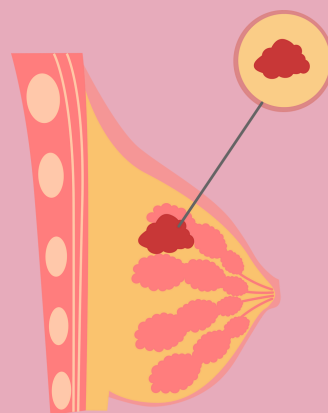
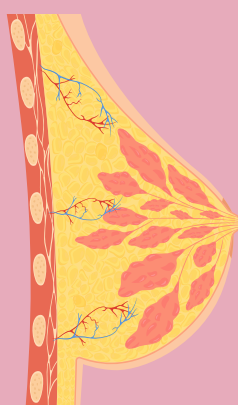
This type of breast cancer forms in the glandular lobules, also known as the milk duct.⁴

Triple-Negative

This type of breast cancer is where the cancer cells don't have any receptors for the HER2 protein or for the estrogen and progesterone hormones.⁴



Healthy vs. Nonhealthy Breasts



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Chapter 2: Risk Factors



Risk Factors

A risk factor is something that can make an individual more likely to get a disease, like breast cancer. Every disease varies in what their risk factors are. Some of these risk factors are modifiable, meaning they can be changed, like not being active. Other risk factors are unmodifiable, which means they can not be changed, like age.

Modifiable Risk Factors

Lack of Physical Activity

Not being active can increase your chances of getting breast cancer. Regular exercise can lower hormone levels that may raise your risk.¹



Drinking Alcohol

Drinking alcohol regularly can raise your risk of breast cancer, especially if you have more than one drink per day. Alcohol can increase estrogen levels, which may lead to the growth of cancer cells.¹



Being Obese/Overweight

Being overweight, particularly after menopause, can increase your risk of breast cancer. Extra fat in the body can produce more estrogen hormones, which can contribute to the growth of cancer cells.²



Unmodifiable Risk Factors

Gender

Women are at a much higher risk of developing breasts than men. Men can develop breast cancer too, but it is less common. This is because women have higher levels of estrogen, which affects cell growth in the breasts. ¹



Age

Risk of breast cancer increases as age increases. Most invasive breast cancers are found in women over 55, which increase with age. Aging affects your hormones, making it easier for cancer to develop. ³

Genetics

Having a family member with breast cancer can increase your risk of developing breast cancer. Gene mutations, such as BRCA1 and BRCA2, can be passed down through families making your risk higher. ²



DISCLAIMER

Just because you have a risk factor doesn't mean you'll definitely get the disease. It's important to be aware of risk factors so you can make healthy choices. Even if you're at higher risk, learning about risk factors can help you cure the disease sooner, when treatment is more effective.

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Chapter 3: Prevention & Risk Reduction



Prevention & Risk Reduction Introduction

As previously explained, there are many factors that may influence your risk for breast cancer. There are some risk factors such as, aging, genetics, and family history that you cannot control.¹ There are also lifestyle choices you can choose to help lower your risk of breast cancer. Some of these lifestyle modifications include maintaining a healthy weight, increasing physical activity, limiting or choosing not to drink alcohol, researching the effects of your hormone replacement therapy or birth control pill, and breastfeeding your children, if possible.¹



Family history of breast cancer and genes are always important to keep in mind when trying to evaluate or reduce your risk. Talk to your doctor about family history and inherited gene changes in your BRCA1 and BRCA2 genes.¹ Remember that it is always beneficial to try and stay healthy throughout your life! Maintaining health at all levels can lower your risk of developing cancer, and improve your chances of surviving cancer if it occurs.¹

Inheriting Gene Changes & Genetic Testing

Inheriting certain gene changes:

About 5% to 10% of breast cancer cases are thought to be passed from parents to their children. This means that they may result directly from gene changes or mutations that are passed on from a parent.²

BRCA1 and BRCA2:

The most common cause of hereditary breast cancer is mutation in the BRCA1 or BRCA2 gene. In normal cells, these genes help make proteins that repair damaged DNA. Mutated versions can lead to abnormal cell growth, which can create cancer. If you have a mutated copy of either gene from a parent, you have a higher risk of getting breast cancer. A woman with a BRCA1 or BRCA2 gene mutation has up to a 7 in 10 chance of getting breast cancer by the age of 80. This chance increases based on how many other family members have had breast cancer.² Similarly, women with one of these mutations are more likely to be diagnosed with breast cancer at a younger age, as well as to have cancer in both breasts.² Women with one of these gene changes also have a higher risk of other cancers such as ovarian cancer and some other cancers. Men who inherit one of these changes also have a higher risk of breast and other cancers.²

Genetic counseling and testing:

- Genetic testing can be done to help look for inherited mutations in those BRCA1 and BRCA2 genes. It is less common but you can also get testing for the other genes listed above.²
- Genetic testing is an amazing option for women who have been diagnosed with breast cancer, as well as for women with factors that put them at higher risk, such as a strong family history.²

Some other less common gene mutations:

ATM: This gene helps repair damaged DNA-Inheriting one abnormal copy of this gene has been linked to a high rate of breast cancer in some families.

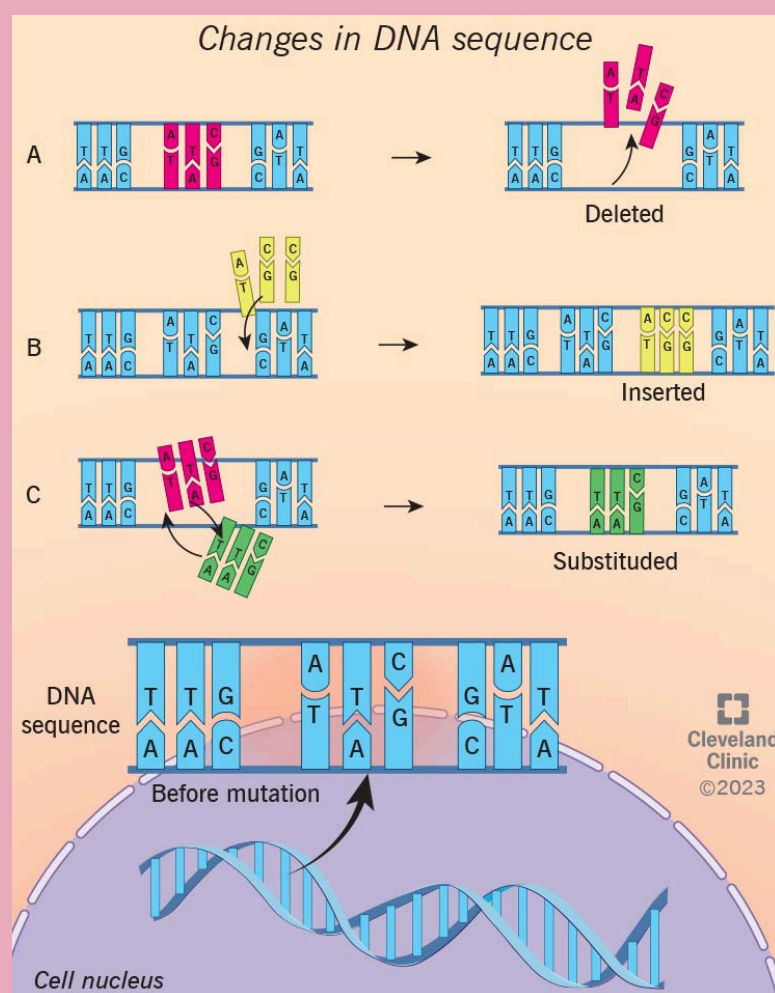
PALB2: Mutations in this gene can lead to a higher risk of breast cancer.

TP53: Inherited mutations of this gene cause Li-Fraumeni syndrome. People with this syndrome have an increased risk of breast cancer.

CHEK2: A mutation of this gene increases breast cancer risk.

PTEN: Inherited mutations in this gene can cause Cowden syndrome, a rare disorder that puts people at higher risk for both cancer and benign (non-cancer) tumors in the breasts.

CDH1: Women with mutations in this gene have an increased risk of invasive lobular breast cancer.



Chemoprevention & Using Preventative Medicine

Chemoprevention: Taking medication that helps lower the risk of getting a disease is called chemoprevention.³

The most commonly used medicines for decreasing breast cancer risk are **tamoxifen** and **raloxifene**.³

Should I take a drug to help reduce my risk?
Most experts say that your risk should be higher than average for you to take one of these medications. If you have a higher-than-average risk, you need to compare the benefits of possibly reducing your chance with the risk of side effects.³



What is Tamoxifen and Raloxifene

What kind of drugs are tamoxifen and raloxifene?

- Tamoxifen and raloxifene are selective estrogen receptor modulators (SERMs). This means that they block estrogen in some tissues of the body, but act like estrogen in others.⁴
- Estrogen can fuel breast cancer cell growth- tamoxifen and raloxifene both block estrogen in breast cells.⁴

Tamoxifen: mainly used to treat hormone receptor-positive breast cancer.⁴

Raloxifene: mainly used to treat osteoporosis in postmenopausal women.⁴

- These drugs are typically taken for 5 years and they are taken once a day.⁴
- Raloxifene is only approved for post-menopausal women.⁴
- When looking at combined results of studies, the overall reduction in risk from these medications is about 40%.⁴

What would this mean for me?

- Although a medicine that cuts your risk by about 40% sounds good, what it means for your health depends on how high your baseline risk is.⁴
- Your doctor can help you estimate your breast cancer risk based on different factors-This can help you see how much potential benefit you might get from chemoprevention.⁴
- The most common side effects of these drugs are symptoms of menopause such as, hot flashes and night sweats. Tamoxifen may also cause vaginal dryness and vaginal discharge. Pre-menopausal women taking tamoxifen can experience menstrual changes. Although menstruation often starts again after the drug is stopped, they don't always, and some women go into menopause. Other side effects such as cancer of the uterus and blood clots are rare.⁴
- Tamoxifen and raloxifene increase your risk of developing blood clots in a vein in your leg (deep venous thrombosis) or in your lungs (pulmonary embolism). This can cause serious problems, and even death.⁴
- In the major studies it was identified that the overall risk of these blood clots over 5 years of treatment was less than 1%- This risk may be higher if you had a serious blood clot in the past. In turn, these drugs may also increase your risk of stroke and heart attack.⁴
- Tamoxifen acts like estrogen in the uterus, therefore this can increase your risk of cancers of the uterus, including endometrial cancer and uterine sarcoma.⁴
 - It's also linked to a higher risk of endometrial pre-cancers. It is important to note that this increased risk seems to mainly affect women over 50.⁴
 - The overall increase in uterine cancer risk from tamoxifen use is low (less than 1%), and it returns to normal within a few years of stopping the drug.⁴
 - If you have had a hysterectomy (surgery to remove the uterus), you are not at risk for endometrial cancer or uterine sarcoma and do not have to worry about these cancers.⁴
- If you are taking tamoxifen, it is important to tell your doctor if you have abnormal vaginal bleeding or spotting.⁴
- Raloxifene does not act like estrogen in the uterus and is not linked to an increased risk of uterine cancer.⁴

What are Aromatase Inhibitors

Aromatase inhibitors: Aromatase inhibitors (AIs) lower estrogen by stopping an enzyme in fat tissue (aromatase) from changing other hormones into estrogen (Estrogen can fuel the growth of breast cancer cells).⁵

Although, these drugs don't stop the ovaries from making estrogen- they only lower estrogen levels in women whose ovaries aren't making estrogen (such as women who have already gone through menopause). Due to this, they are used mainly in women who have already experienced menopause.⁵ The 2 main AIs that have been shown to lower breast cancer risk include:

- Anastrozole or Arimidex
- Exemestane or Aromasin

These drugs are typically taken for 5 years-They are pills taken once a day.⁵ In large research studies, anastrozole and exemestane have been shown to lower breast cancer risk in postmenopausal women who are at increased risk.⁵

- These drugs are not FDA approved to lower breast cancer risk, but some experts include them as options to reduce breast cancer risk in postmenopausal women at increased risk.⁵
- They might be a good option for women who have an increased risk of blood clots and therefore should not take medications like tamoxifen or raloxifene.⁵

The most common side effects of AIs are symptoms of menopause, such as hot flashes, night sweats, and vaginal dryness. These drugs may also cause muscle and joint pain.⁵ Unlike tamoxifen and raloxifene, AIs tend to speed up bone thinning, which can lead to osteoporosis.⁵

AIs may raise cholesterol. Therefore, women with pre-existing heart disease who take an AI may be at higher risk of having a heart problem.⁵

Preventive Surgery

Key terms:

1) Prophylactic: something used to prevent disease⁶

2) Mastectomy: surgery to remove one or both breasts to lower the chances of getting breast cancer⁶

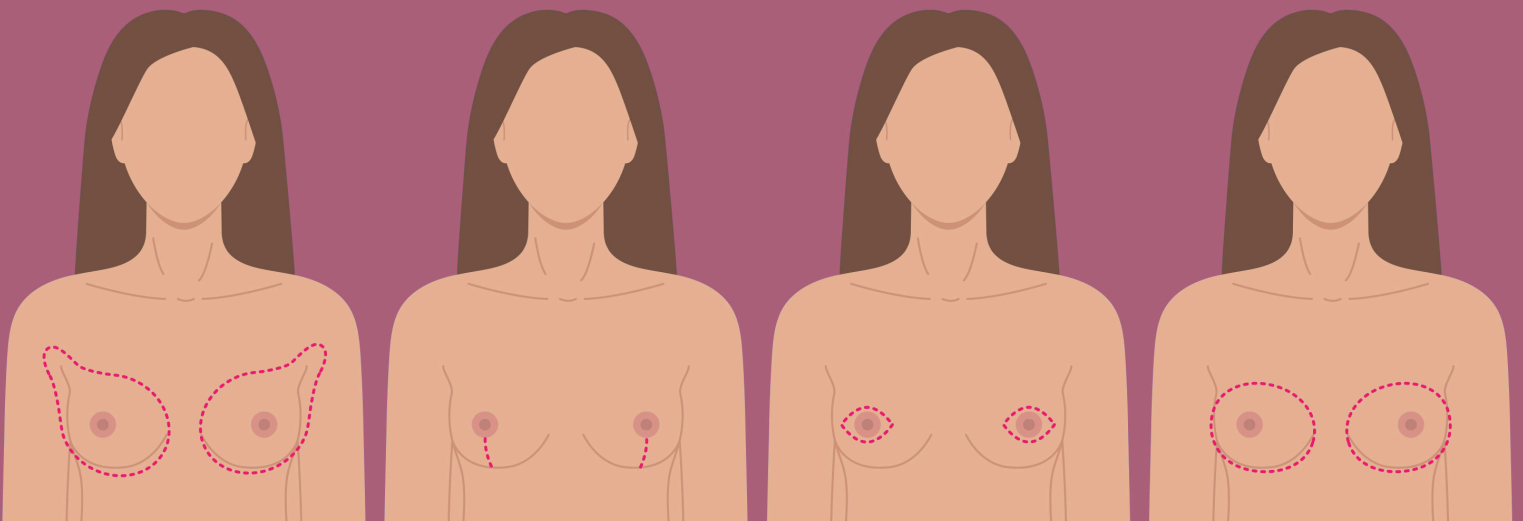
3) Contralateral prophylactic mastectomy (CPM): when women who have already been diagnosed with breast cancer may choose to have the other breast removed at the same time of surgery to remove the breast with cancer.⁶

You might consider preventive surgery if you:

- Found you have a mutation in the BRCA1 or BRCA2 gene from genetic testing⁶
- Have a strong family history of breast cancer (such as breast cancer in several close relatives, or breast cancer in at least one relative at a young age)⁶
- Had radiation therapy to the chest before age 30⁶
- Have/had cancer in one breast⁶
- For women who have a BRCA1 or BRCA2 gene mutation, a prophylactic oophorectomy (removal of the ovaries) might be recommended⁶

A prophylactic mastectomy can lower breast cancer risk by 90% or more, but it doesn't make your chances of getting breast cancer 0%. This is because it's impossible to remove all breast cells, even with surgical removal.⁶ Unfortunately there's no way to know for sure ahead of time if someone will benefit from a mastectomy.⁶ Most women with a BRCA1 or BRCA2 gene mutation will develop breast cancer at some point, so getting a prophylactic mastectomy before the cancer develops might add years to their lives. For some women with the gene mutation, a mastectomy might not be as helpful.⁶ They may get peace of mind but they would also have to deal with potential physical and emotional side effects. CPM is a good option for women who have other factors that increase their risk of getting another occurrence of breast cancer. Factors include having the BRCA1 or BRCA2 mutation or a strong family history of breast cancer.⁶

Types of Double Mastectomies



Modified radical double mastectomy

Nipple-sparing double mastectomy

Skin-sparing double mastectomy

Total double mastectomy

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Chapter 4 : Screening



What is Breast Cancer Screening?

Breast Cancer Screening is the process of checking for cancer in the breasts before signs or symptoms of the disease develop¹.



Why is early screening important?

Early screening does not prevent cancer, but finding it early can make breast cancer easier to treat and recover from.¹



Screening Fears and Concerns

Breast Cancer screening can be scary especially when you don't have all the facts. Talk to a your doctor about your screening plan so that you can be confident about your health.

Types of Breast Cancer Screening

Self Exam

What is a self exam?

A self exam is a way to check your breasts yourself, in order to recognize any changes that could be a sign of infection, disease or cancer.² Changes do not always mean there is cancer, but any changes in your breast should be discussed with your doctor.²

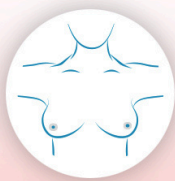
When should I preform a self exam?

Best practice is to preform a self breast exam once a month after your period since menstrual hormones can affect breast feel². Preforming a self exam once a month allows you to be familiar with how your breast usually feel so you can notice changes.²

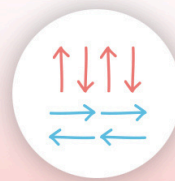
HOW TO DO A BREAST SELF-EXAM IN 6 STEPS



DO ONCE A MONTH, A WEEK AFTER YOUR PERIOD



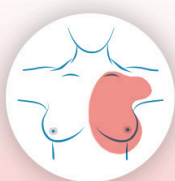
LOOK IN THE MIRROR FOR ANY ASYMMETRIES



TOUCH ALL PORTIONS OF YOUR BREASTS—UP AND DOWN & LEFT TO RIGHT



START FEELING FOR LUMPS OR MASSES



CHECK FROM THE UNDERARM AREA TO THE CHEST WALL & STERNUM



CONDUCT THE SELF-EXAM STANDING UP OR LYING DOWN

How do I preform a self exam?

Visual: Standing straight with your arms at your side in front of a mirror, look for any new changes in shape, color or to the skin of your breasts. Also check for any changes to the position, shape, or color of your nipples. Then repeat these step with your arms up in the air.²

Physical: The physical exam is done by using your right hand to check your left breast and you left hand to check your right breast. A physical exam may be easier in the shower but is not required. Using the tips of your three middle fingers, apply light, medium and firm pressure to the entire breast and armpit area.² Feel for any lumps, changes in thickness, or other changes. Additionally make sure to apply pressure to the nipple to check for any drainage.²

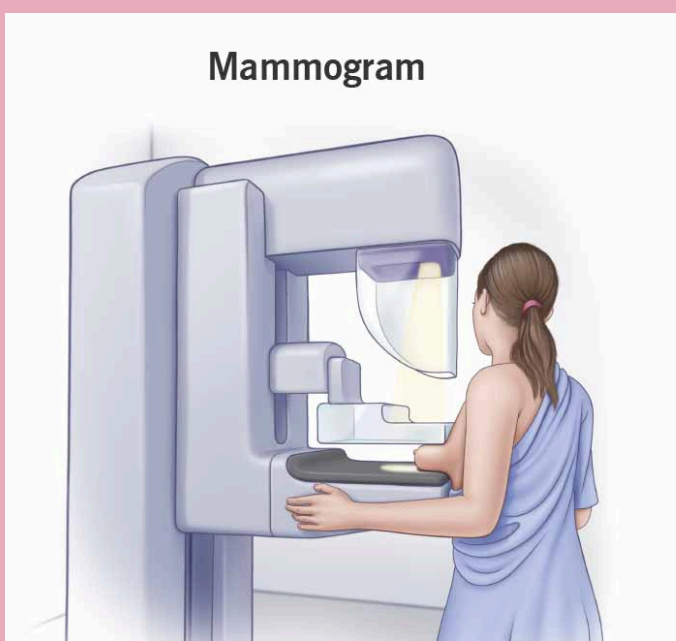
Any new changes should be discussed with your doctor to determine next steps.

Types of Breast Cancer Screening

Mammogram

What is a Mammogram?

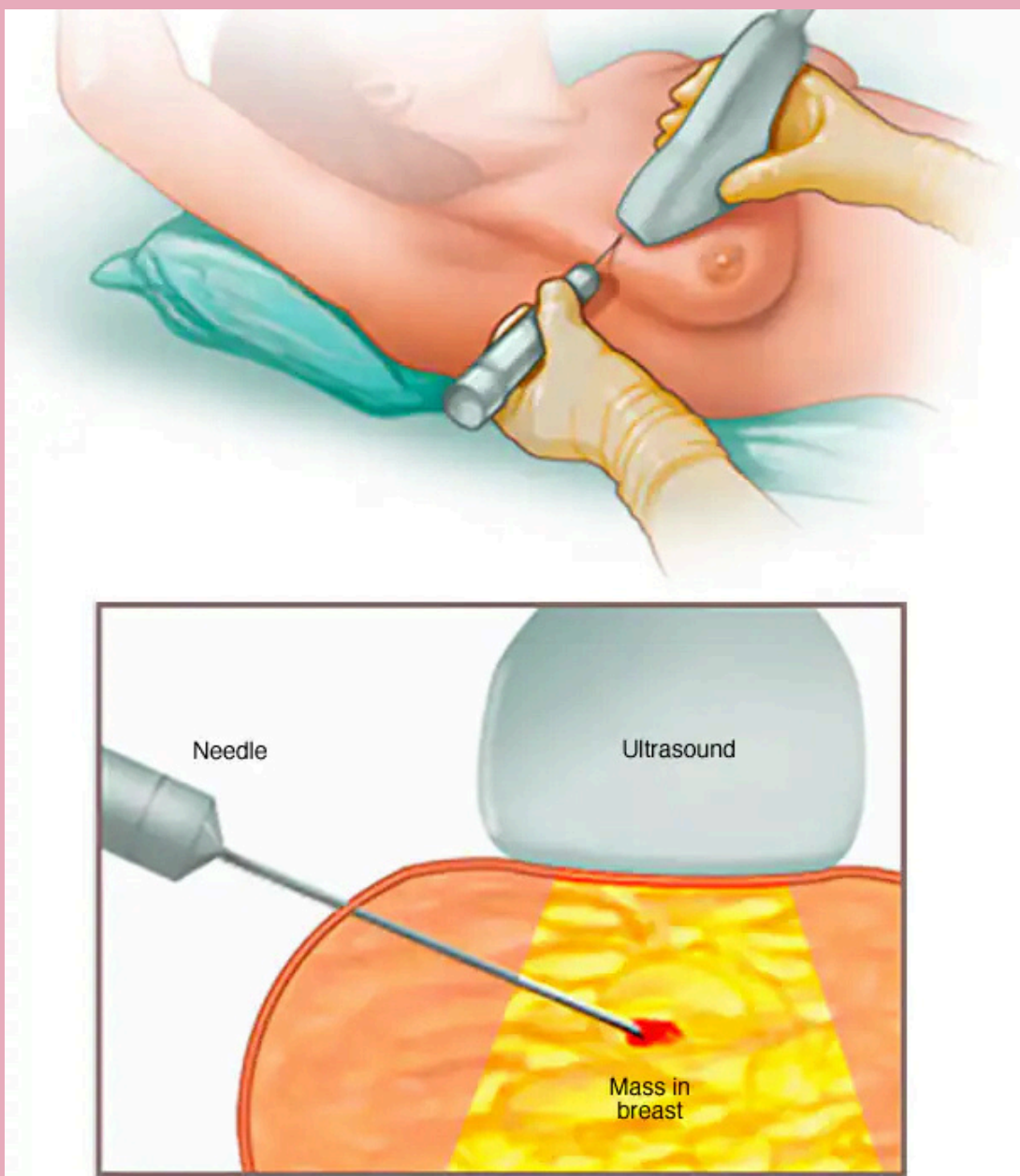
A mammogram is an X-ray of the breasts. In most cases, a mammogram is the best way to find breast cancer early.¹ Women ages 40-74 years old are encouraged to have a mammogram every 2 years to screen for cancer.¹ Ask your doctor if you would benefit from getting regular mammograms.



Breast Biopsy

What is a Breast Biopsy?

If a new change in your breasts is found through a self exam, or a mammogram, your doctor may want to perform a breast biopsy.³ A breast biopsy uses a needle to go into the breast and remove a small tissue sample to be tested for cancer and other diseases.³ This is how any breast cancer or other breast disease will be diagnosed.³



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Chapter 5: Stages of Breast Cancer

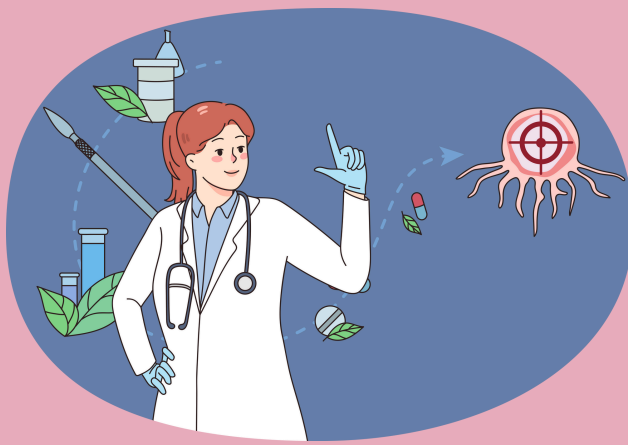


Stages of Breast Cancer

How is Breast cancer classified?

Breast cancer is development categorized into stages by doctors according to factors like size and how far it's spread.¹ What stage breast cancer is in helps you and your doctor pick treatment and project your outcome.¹

*Note, typically stages are numbered with roman numerals ie. I, II, III, IV, but roman numerals are not used in this chapter for ease of understanding.



Stage 0 Breast Cancer

Stage 0 breast cancer is breast cancer that is not spreading to other tissues or cells.¹

Stage 1 Breast Cancer

Stage 1 breast cancer is breast cancer that is breaking through and spreading into other cells and tissues.¹

Stage 1 is broken up into Stage 1A and 1B.

In stage 1A breast cancer the tumor is up to 2cm, and the cancer has not spread out of the breast into the lymph nodes.¹

In stage 1B breast cancer there may be no tumor in the breast, but there are be small groups of cancer cells no larger than 2mm in the lymph nodes.¹

Stage 2 Breast Cancer

Stage 2 breast cancer is broken up into Stage 2A and 2B.

In stage 2A breast cancer no tumor may be found but cancer up to 2mm is found in 1-3 lymph nodes, or a tumor no larger than 5cm is present in the breast and may have spread to the lymph nodes.¹

In stage 2B breast cancer, a tumor no larger than 5cm is present in the breast and has spread to the lymph nodes of the breast bone, or a tumor larger than 5 cm is present in the breast and has not spread to the lymph nodes.¹

Stages of Breast Cancer

Stage 3 Breast Cancer

Stage 3 breast cancer is broken up into Stage 3A, 3B and 3C.

In stage 3A breast cancer no tumor may be found but cancer is found in 4-9 lymph nodes, or a tumor larger than 5cm is present in the breast and has spread to 1-3 lymph nodes.¹

In stage 3B breast cancer, the tumor can be of any size and has spread to the chest wall or the skin of the breast causing swelling, or may have spread to 9 lymph nodes.¹

In stage 3C breast cancer, the tumor can be of any size and has spread to the chest wall or the skin of the breast causing swelling and has spread to 10 or more lymph nodes.¹

Stage 4 Breast Cancer

Stage 4 breast cancer is breast cancer that has spread past the breast and surrounding lymph nodes to other bodily organs and or distant lymph nodes.¹

This kind of breast cancer may be called metastatic, which means it has spread to another part of the body.¹

Medical advice

Everybody's body is different and cancer is a very complicated disease. Make sure to talk to your doctor about any cancer diagnosis to get the most detailed and specific information about your health, possible treatment and possible outcomes.



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Chapter 6: Types of Treatment



Types of Treatment

Treatments of Breast cancer can range from surgery, chemotherapy, Radiation, Hormonal Therapy, Immunotherapy, and drug therapy¹.

Surgery Options

There are two main types of surgery to remove breast cancer. Breast-conserving surgery removes the cancer and a small amount of surrounding tissue, but not the entire breast. It's also called a lumpectomy or partial mastectomy. The amount removed depends on the size and location of the tumor. Mastectomy involves removing the entire breast and sometimes nearby tissues. In some cases, both breasts may be removed, which is called a double mastectomy²

Chemotherapy

Chemotherapy is a treatment that uses strong medicine to kill cancer cells. It's usually given through a vein (IV) or as a pill, and it travels through the body to target cancer. Chemo can be used after surgery (called adjuvant chemo) to destroy any hidden cancer cells, or before surgery (neoadjuvant chemo) to shrink the tumor and make surgery easier. It's also used when breast cancer has spread to other parts of the body, like the lungs or liver. Treatment is given in cycles with breaks in between and usually lasts 3 to 6 months or longer, depending on the type and stage of cancer. Common side effects include hair loss, nausea, tiredness, mouth sores, and a higher risk of infection. The good news is most side effects go away after treatment, and there are ways to help manage them².

Types of Treatment

Treatments of Breast cancer can range from surgery, chemotherapy, Radiation, Hormonal Therapy, Immunotherapy, and drug therapy.

Hormonal Therapy

Some types of breast cancer are hormone-sensitive, meaning they grow in response to the hormones estrogen and progesterone. These cancers have receptors that attach to these hormones, encouraging cancer growth. Hormone therapy, also known as endocrine therapy, works by either lowering estrogen levels or blocking the hormones from attaching to cancer cell receptors, helping to slow or stop the cancer's growth. It's mainly used for hormone receptor-positive breast cancer and is typically given after surgery (adjuvant therapy) to reduce recurrence risk, or before surgery (neoadjuvant therapy) to shrink tumors. About two-thirds of breast cancers are hormone receptor-positive, and treatments vary based on menopausal status and the specific characteristics of the cancer. Selective estrogen receptor modulators (SERMs), such as tamoxifen and toremifene, block estrogen's effects and are commonly used after surgery or to reduce risk in high-risk women, with side effects like hot flashes, vaginal changes, and rare risks such as blood clots or stroke²

Drug Therapy

Targeted drug therapy for breast cancer² uses medicines aimed at specific proteins on cancer cells that help them grow and survive. Unlike chemotherapy, these drugs often have different side effects and may work even when chemo does not. Some, like monoclonal antibodies, also act as immunotherapy by boosting the immune system. These drugs are especially useful for treating HER2-positive breast cancer, which makes up 15% to 20% of breast cancers and tends to be more aggressive²

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<https://www.cancer.gov/types/breast/patient/breast-treatment-pdq>

3. Breast cancer

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Chapter 7: Post Treatment



Monitoring & Follow-Up Care

Breast cancer treatment is just one step in your journey. After treatment ends, the focus is to stay healthy. Post-treatment care is very important in keeping you well in the long term.

Check-Ups and Surveillance

Post-Treatment Appointment Schedule

1st - 3rd
year

Appointments are every **3 to 4 months**.¹

What to expect:

- Imaging tests (MRIs, mammograms, ultrasounds)¹
- Physical exams¹
- Blood tests for tumor markers¹

3rd - 5th
year

Appointments are **once a year**.¹

What to expect:

- Mammograms or other imaging¹
- Annual physical exams¹
- Long-term side effect management¹

5+
years

Appointments are **once a year**.²

What to expect:

- Routine Monitoring through regular check-ups²
- Monitoring for second cancers²
- Prolonged side effect care²

Signs to look for



New lump or pain in chest area

A new bump that feels different from the surrounding tissue or persistent pain in the breast may be an indicator of the cancer reoccurring.³



Bone Pain

Persistent bone pain in areas such as your back or hips may be a sign of possible bone cancer post-treatment.³



Changes in Nipple

Changes in your nipple such as discharge (yellow or red) or your nipple turning inward may be a indicator of cancer reoccurrence.³

IF YOU ARE EXPERIENCING ANY OF THESE CONTACT YOUR DOCTOR.

Long-term Treatment Side Effects

Chemotherapy Side Effects

- **Fatigue:** tiredness that doesn't go away with rest can last months or years after chemotherapy.⁴
- **Heart Problems:** long-term damage due to certain drugs used in chemotherapy can increase the risk of heart failure.⁴
- **'Chemo Brain':** Memory problems and issues with concentration can last for months or years after chemotherapy.⁴

Radiation Side Effects

- **Lymphedema:** persistent swelling in the arm or chest area occurs due to radiation targeting the lymph nodes.⁵
- **Skin issues:** constant dryness or irritation can make your skin more sensitive.⁵
- **Heart/Lung Problems:** Radiation is directed near your chest and can lead to heart and lung diseases.⁵

Surgery Side Effects

- **Nerve Damage:** numbness or tingling in the breast area may occur due to nerve injury during surgery.⁴
- **Scarring & Cosmetic Changes:** long-term appearance of the breast may change which includes asymmetry and visible scarring.⁴
- **Lymphedema:** persistent swelling in the arm or chest area occurs due to radiation targeting the lymph nodes.⁴

Tips for Living Healthy Post-Cancer

Physical Health



- **Eat Healthy:** Try to focus on vegetables, fruits, and healthy fats. This will increase your strength and decrease your risk of reemerging issues.⁶
- **Stay Active:** Although difficult, it's important to incorporate any type of physical activity during and post treatment. This will increase your energy.⁶
- **Don't Smoke:** Smoking can increase your risk of a second cancer or even heart disease. Avoid it to improve your health.⁷

Mental Health



- **Acknowledge Your Emotions:** It's normal to feel sad, scared or mad. Allow yourself to feel your emotions.⁷
- **Talk to Someone:** Reach out to friends, family, or a therapist about your concerns. Let others know what you need.¹
- **Set Realistic Goals:** Break tasks into small tasks and give yourself credit.¹

For support and resources:

Contact the National Alliance on Mental Health (NAMI) Helpline at **800-950-NAMI** or visit **nami.org**.



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Chapter 8: Future Advancements & Research



Current Breast Cancer Research

Key terms:

1) Clinical trials: are controlled studies that may collect specific information about certain diseases as well as explore new treatment options.¹

2) Research studies: range from studies done within a lab setting to clinical trials done with hundreds of thousands of people.¹

The current advancements and ideas on preventing and reducing breast cancer risk stem from information discovered from cancer research studies.¹ Research studies continue to look at how lifestyle factors, behaviors, inherited gene changes, and environmental factors impact breast cancer risk.¹

Current research examples:

- Studies are looking at the effects of physical activity, weight, and diet on breast cancer risk.¹
- Some breast cancers run in families, but many of the gene mutations (changes) that cause these breast cancers are not yet known. Research is being done to look at these understudied gene changes.¹
- Several studies are focusing on the best use of genetic testing for inherited breast cancer gene mutations.¹
- Scientists are exploring how common gene variants (small changes in genes that are not as significant as mutations) may affect breast cancer risk. Gene variants typically have only a modest effect on risk by themselves, but when combined they could possibly have a large impact.¹
- Possible environmental causes of breast cancer have also received more attention in recent years. While much of the science on this topic is still in its earliest stages, this is an area of active research.¹

Current Research on Reducing Breast Cancer Risk

Researchers are looking for ways to reduce breast cancer risk, especially for high risk women. Here are some examples:

- Studies looking at whether levels of physical activity, losing weight, or eating certain diets might help lower breast cancer risk.¹
- Chemoprevention and hormonal medicines such as tamoxifen, raloxifene, exemestane, and anastrozole have already been shown to help lower risk for certain women at higher risk and researchers are continuing to study these options¹
- Clinical trials are looking at whether some non-hormonal drugs might lower breast cancer risk. An example would be drugs used to treat blood or bone marrow disorders, like ruxolitinib.¹
- Studies are looking at vaccines that might help prevent certain types of breast cancer in people who have a higher risk¹

Breast cancer tissue is tested for biomarkers ER, PR, and HER2 to help make medical decisions. A biomarker is any gene, protein, or substance that can be measured in blood, tissues, or body fluids.¹

Some biomarker research includes:

- Studies are looking at whether testing for biomarkers, such as HER3, might be helpful for prevention methods.¹
- A growing area of study for biomarkers is circulating tumor DNA (ctDNA). This is DNA that is released into the bloodstream when cancer cells die.¹

Some ways ctDNA might be used for breast cancer reduction include:

- Looking for new biomarkers in the tumor cells that might show that the breast cancer has become resistant to specific treatments like chemo¹
- Determining if a drug will work on a tumor before trying it¹
- Predicting if breast cancer will come back in women with early-stage breast cancer¹
- Predicting if treatment is destroying the tumor instead of utilizing imaging tests such as a CT scan¹
- Determining if breast cancer is present before changes are found on an imaging test¹

New tests are being developed for breast imaging. It will take time to see if they work well like tests used today.¹

Some of these developing tests include:

- Scintimammography (molecular breast imaging)
- Positron emission mammography (PEM)
- Electrical impedance imaging (EIT)
- Elastography
- New types of optical imaging tests

Current Research on Breast Cancer Treatment

Some current research involving breast cancer treatment include:

- Studying if shorter courses of radiation therapy for very early-stage breast cancers are as good as the longer courses used ¹
- Testing if different types of radiation therapy are better than standard radiation. ¹
- Combining drugs to see if they work better together ¹
- Trying to find new drugs/drug combinations that might help treat breast cancer that has spread to other parts of the body, like the brain ¹
- Trying different immunotherapy drugs to treat triple-negative breast cancer ¹
- Giving cancer vaccines to see if this helps keep the cancer from worsening and/or coming back ¹
- Finding new ways to treat women with hereditary breast cancer, because they have a higher chance of the cancer coming back ¹
- Determining if chemotherapy is needed to treat every single woman with HER2-positive breast cancer ¹
- Finding new options for when breast cancer becomes resistant to current treatment options ¹



Surgery



Targeted therapy



Radiation



Chemotherapy



Hormonal therapy

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Chapter 9: Summaries



Chapter 1

This chapter introduces the condition called breast cancer. This chapter talks about what the condition is, who it affects, what specific body parts it affects, and the different types of breast cancers.

Chapter 2

This chapter explores the risk factors associated with breast cancer, dividing them into modifiable and unmodifiable factors. It emphasizes the ability to change modifiable factors and how each risk factor contributes to overall risk.

Chapter 3

This chapter highlights that about 5–10% of cases are inherited, with gene mutations being the most common cause. These mutations significantly increase breast cancer risk. Genetic counseling and testing can help identify individuals at higher risk. To reduce risk, medications like tamoxifen and raloxifene, can lower risk by about 40%, but they come with potential side effects. Aromatase inhibitors are another option, particularly for postmenopausal women. In high-risk cases, options like prophylactic mastectomy or contralateral prophylactic mastectomy may be considered to further reduce risk.

Chapter 4

This chapter explains what breast cancer screening is, discusses its importance and explains the types of screening. The types of screening covered are self breast exams, mammograms and breast biopsy.

Chapter 5

This chapter explains how breast cancer development is categorized. The stages of breast cancer covered in this chapter are stages 0, 1A, 1B, 2A, 2B, 3A, 3B, 3C, and 4. Roman numerals are not used to denote stages in this chapter for ease of understanding for the reader.

Chapter 6

This chapter describes the different types of treatment that are used to treat breast cancer. With each type, there is a description that specifically describes the treatment style and how it works to combat the condition. These treatments are also specific to the types of breast cancer that were listed in the introduction chapter

Chapter 7

This chapter outlines what to expect after breast cancer treatment. This includes follow-up checkup setups, signs to watch for, and common long-term side effects. It also offers practical tips for physical and mental health.

Chapter 8

This chapter explains that current research is focused on understanding risk factors. Scientists are also looking at genetic testing and investigating new biomarkers, such as circulating tumor DNA, to detect cancer earlier and tailor treatments. There are advances in imaging technologies and treatment options—like shorter radiation courses, drug combinations, immunotherapy, and cancer vaccines. These studies aim to improve outcomes, especially for high-risk or treatment-resistant cases.