Pink Halos
Breast Cancer

By: Harini Mohan, Eshan Shah, Sanjana Surapaneni, Rohan Anne, and Zeid Amer

BREAST CANCER HUB℠

We're all from Alliance Academy for Innovation down in Cumming, GA!

Corresponding author:
Dr. Lopamudra Das Roy
Questions, please reach out:
lopa@breastcancerhub.org

Abstract (0)

The Pink Halos researched breast cancer, its developments , and its correlated receptors. Breast cancer is a form of cancer when cells start to grow out of control in the breast tissue. When the tumor is malignant, then the term cancer is applied to the situation. This malignant tumor can spread and start to invade other areas of the body. The specific topic we received was receptors and their correlation to cancer. These are the markers for breast cancer cells that help doctors identify and formulate a treatment plan. We strived to learn more about these receptors wondering if it could lead us to a new way of thinking about treatments and maybe even cures. We aspire to be part of the next generation of doctors and understanding aspects of cancer is a key part to the future.

Risk Factors (1)(2)

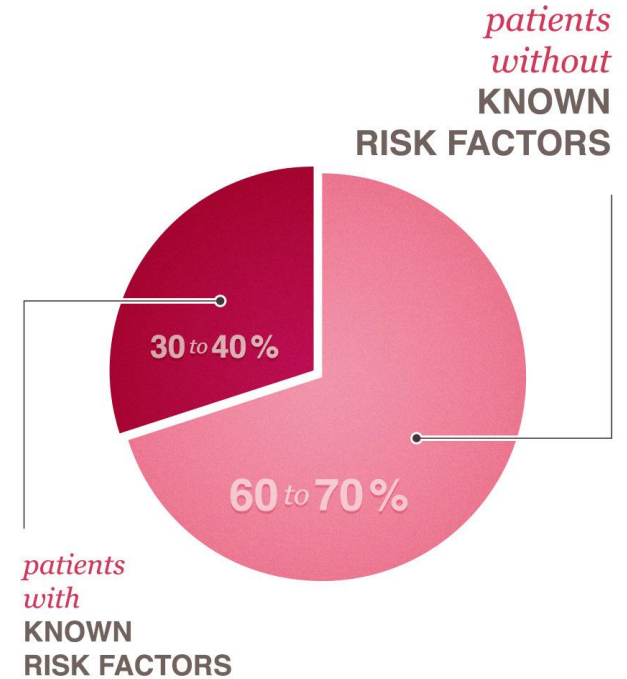| Controllable Factors	Uncontrollable Factors
★ Not being active ★ Being overweight ★ Being pregnant over the age of 30, not breastfeeding and never having a "normal pregnancy" may cause problems. (This does not apply to everyone but it may increase chances for some) ★ Hormonal therapy such as estrogen and/or prestogerone medications consumed during menopause ★ Birth control pills (Taking birth control pills may increase chances due to fluctuating hormone levels ★ Alcohol consumption ★ Nicotine/ other chemicals found in drugs such as cigarettes and vapes ★ Chemicals found in unhealthy foods, cheap plastic with Bpa, and cosmetic products	★ Aging (breast cancer is most commonly found in those over the age of 50) ★ Dense breasts (having more connective tissue than fat) ★ If the patient has had breast cancer or another illness located in the breast in the past ★ Family history of breast cancer ★ Early beginnings to periods (before age 12) and late continuations of periods (after age 55) ★ Radiation Therapy ★ Genetic Mutations such as BRCA1 and BRCA2 (inherited) ★ DES (Diethylstilbestrol) *Having these factors increase your chances of breast cancer but do not necessarily mean you will **definitely** contract breast cancer.

Causes (3)

★ In most cases doctors aren't able to locate the exact cause an individual contracted breast cancer due to the possibility of having many different risk factors contribute.

★ Some women/men take part in many different risk factors but never contract breast cancer, it is unpredictable but we can prevent it somewhat by leading a moderately healthy life.

★ *No real cause just risk factors that may or may not contribute to its contraction

patients without **KNOWN RISK FACTORS**

30 *to* **40 %**

60 *to* **70 %**

patients with **KNOWN RISK FACTORS**

National Breast Cancer Foundation

Diet (4)

After a diagnosis of Breast cancer, women tend to re-evaluate their lifestyle, specifically their diet and making it healthier. A healthy diet is actually one of several factors that affect your immune system. While there are no magic nutrient pills, there are foods that you can increase.

- ★ Increase fruits, vegetables, and whole grains.
- ★ Decrease fat intake to less than 30% intake of calories.
- ★ Minimize cured, pickled and smoked foods
- ★ Achieve and maintain a healthy weight
- ★ Alcohol consumption should be very limited
- ★ Smoking

Types of Breast Cancer with Treatments(15)

Doctors are starting to use genetic information about breast cancer cells to categorize them into different groups. These groups help to make decisions about the treatments that are best.The groups include:

Group 1(luminal A)	Group 2(luminal B)	Group 3(HER2 Positive)	Group 4(basal-like)
This group includes tumors that are ER positive and PR positive, but negative for HER2. Luminal A breast cancers are likely to benefit from hormone therapy and may also benefit from chemotherapy.	This type includes tumors that are ER positive, PR negative and HER2 positive. Luminal B breast cancers are likely to benefit from chemotherapy and may benefit from hormone therapy and treatment targeted to HER2.	This type includes tumors that are ER negative and PR negative, but HER2 positive. HER2 breast cancers are likely to benefit from chemotherapy and treatment targeted to HER2.	This type, which is also called triple-negative breast cancer, includes tumors that are ER negative, PR negative and HER2 negative. Basal-like breast cancers are likely to benefit from chemotherapy.

ACS Breast Cancer Statistics 2019 (0)

Breast cancer is the most common cancer in American women, besides skin cancers. Currently, the average risk for a woman developing it is 12%. Basically a 1 in 8 chance she will develop breast cancer. These are the estimates from the ACS for 2019.

★ About 268,600 new cases of invasive breast cancer will be diagnosed in women.
★ About 62,930 new cases of carcinoma in situ (CIS) will be diagnosed
★ About 41,760 women will die from breast cancer.

★ **What is the difference between stages and grades?** Breast cancer grades are how similar your breast cells with cancer are to those without cancer, a grade tells you how fast your cancer cells are spreading. On the other hand breast cancer stages tell you how far your cancer has spread and its severity.
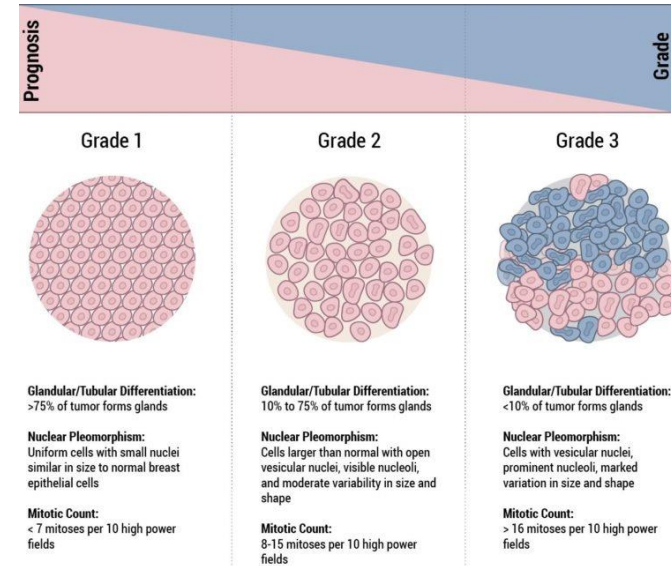
Stages (5) (6)

Stage 0 (Carcinoma in Situ, pre-invasive)	Stage 1(A & B)	Stage 2(A & B)	Stage 3 (A, B, & C)	Stage 4 (Metastatic)
There is no evidence of cancer cells; no proof of abnormal cells breaking out to become cancerous. (Appears to be normal)	An invasive stage 1A: tumor is up to 2 cm, cancer has not spread outside the breast, no lymph nodes involved. 1B: No tumor in breast, instead groups of cancer cells:0.2-2 mm, found in lymph nodes. Sometimes also found with tumor no larger than 2cm	An invasive stage 2A: Tumor is between 2 - 5 centimeters and the cancer has moved into 1 out of 3 axillary lymph nodes. 2B: tumor may be between 2 - 5 centimeters or larger than 5 centimeters, like stage 2A this stage will also have the tumor move away from the breast and cancer into the lymph nodes. Has groups of cancer cells that're .2 - 2 mm.	An invasive stage 3A: No tumor is found in breast but the cancer is found in 4-9 axillary lymph nodes. The tumor is usually larger than 5 centimeters. 3B: Tumor can be any size and can spread to the chest wall +/ the skin on the breast. The cancer will also spread to up to 9 lymph nodes and may spread to those around the breastbone. 3C: May not show signs of cancer in breast, but the cancer can spread up to 10 axillary lymph nodes around the collarbone/breastbone	Very invasive stage Breast cancer that spreads past the breast and close lymph nodes affected in the other stages and into other vital organs such as skin, bones, lungs, liver, and farther placed lymph nodes.

Grades (6)(7)

GRADE 1	GRADE 2	GRADE 3
★ Cells look mostly like normal breast cells. ★ Slow growth rate of cancer affected cells.	★ Cells look somewhat normal compared to unaffected breast cells. ★ Average growth rate of cancer affected cells.	★ Cells look very different from normal breast cells. ★ Rapid growth rate of cancer affected cells.

Prognosis | Grade

Grade 1

Glandular/Tubular Differentiation:
>75% of tumor forms glands

Nuclear Pleomorphism:
Uniform cells with small nuclei similar in size to normal breast epithelial cells

Mitotic Count:
< 7 mitoses per 10 high power fields

Grade 2

Glandular/Tubular Differentiation:
10% to 75% of tumor forms glands

Nuclear Pleomorphism:
Cells larger than normal with open vesicular nuclei, visible nucleoli, and moderate variability in size and shape

Mitotic Count:
8-15 mitoses per 10 high power fields

Grade 3

Glandular/Tubular Differentiation:
<10% of tumor forms glands

Nuclear Pleomorphism:
Cells with vesicular nuclei, prominent nucleoli, marked variation in size and shape

Mitotic Count:
> 16 mitoses per 10 high power fields

Breast Cancer Receptor Types and Treatments (8)(9)

Hormone Receptors	Protein Receptors
Breast cancers that have the receptors for hormone estrogen are called estrogen receptor positive. About 70% of breast cancers are ER positive breast cancer. They respond positively to hormone therapies. ER negative breast cancers do no carry hormone receptors.	Some breast cancers have high amounts of receptors for the protein HER2. HER2 is human epidermal growth factor 2. Its just called HER2 positive breast cancers. About 15% or 1 in 7 women with early breast cancer have HER2 positive. A drug called trastuzumab is usually an effective treatment.

★ If the cancer does not have receptors for either HER2 or ER positive, it is called triple negative breast cancer. This affects 1 in 5 women, more common in younger women.

TNBC (Triple negative breast cancer)(10)

The Immunotherapy Era for TNBC

An important part of the immune system is its ability to keep itself from attacking normal cells in the body. To do this, it uses "checkpoints" – proteins on immune cells that need to be turned on (or off) to start an immune response. PD-L1 inhibitors
Atezolizumab (Tecentriq) targets PD-L1, a protein that is found on some tumor cells and immune cells. Blocking this protein can help boost the immune response against breast cancer cells. This can shrink some tumors or slow their growth.
Atezolizumab can be used along with Abraxane (albumin-bound paclitaxel) in people with advanced triple negative breast cancer whose tumor makes the PD-L1 protein. It can be used as part of the first treatment in some people.
Atezolizumab is given as an intravenous (IV) infusion every 2 weeks.

(background for TNBC treatment from Word)

TNBC Clinical Trial #1 (11)

Sacituzumab Govitecan-hziy in Refractory Metastatic Triple-Negative Breast Cancer. Sacituzumab govitecan-hziy is an antibody-drug conjugate that combines a humanized monoclonal antibody, which targets the human trophoblast cell-surface antigen 2 (Trop-2), with SN-38, which is conjugated to the antibody by a cleavable linker. Sacituzumab govitecan-hziy enables delivery of high concentrations of SN-38 to tumors.

Description	Results	Cons
108 patients received sacituzumab govitecan-hziy at a dose of 10 mg per kg of body weight, after receiving at least two previous treatments.	4 deaths occured Overall 13.0 months of survival	Adverse myelotoxic effects.

Palestine Breast Cancer Epidemic (12)

	GAZA STRIP	WEST BANK	ISRAEL
Screening	Out of 3,055 participants 64.2% reported that they rarely or never exam their breasts.	60% of females over the age of 50 have never attended a mammography session	70% of females over the age of 50-69 have attended
Survival Rate	65% of women survive 5 years after diagnosis	N/A due to the lack of education and resources dedicated to breast cancer research in this area.	86% survival rate 5 years after diagnosis

Palestinian Barriers (12)

Many palestinians need a permit from the Israeli government to leave the Gaza Strip and West Bank.. Due to this process, as many as 39% of Gaza Strip residents who signed up for a permit are denied after months of waiting after diagnosis. Early diagnosis is important, but if treatment can not be accessed then survival rates can decrease significantly.

"Khadijah, a 32-year-old mother of 4, noticed something unusual with her breast in December 2017. Soon doctors confirmed she had breast cancer. In January 2018, Khadijah applied for a permit to go to Augusta Victoria Hospital in East Jerusalem for a specialized investigation – to see whether the cancer had spread and if so, how far. Her permit was denied. She started receiving chemotherapy in Gaza, but for optimal treatment surgery was needed. In July, Khadijah reapplied for a permit, and again was denied. She decided to change her treatment destination to Egypt. Khadijah's second attempt to leave Gaza to Egypt was finally successful. She had surgery in August 2018, 7 months after diagnosis," stated by World Health Organization.

Breast Cancer Statistics India 2018 (13)

New Cases Registered	Deaths
162,468	87,090

Overall, 1 in 28 women is likely to develop breast cancer during her lifetime.The incidence rates in India begin to rise in the early thirties and peak at ages 50-64 years.

Challenges (14)

Physical and Mental

Weight Gain
Cognitive Dysfunction
Late Cardiovascular Effects
Arthralgia/joint symptoms
Reduced productivity
Chronic Fatigue
Premature Ovarian Failure
Sexual Dysfunction
Other 2nd Malignancy
(ie. endometrial cancer)
Osteoporosis/Bone
fractures

Depression
May develop PTSD
Elevated levels of
stress, anxiety, and
fear
Some breast cancer
Mood swings
Chronic fatigue
(sometimes caused
by intense radiation
and chemotherapy

- Specific treatment plans
  - Dependent on the person
  - Can include surgery, radiation, chemotherapy, hormone therapy, targeted therapy and/or immunotherapy
- Sequential & Combination Treatments
  - Sequential treatments are those treatments after one another meanwhile combination treatments are multiple treatments at once. Their doctor will suggest either, depending on the patient.
- Therapeutic Approaches/Combinations
  - Reduces risk of it coming back
  - Improve PFS in the metastatic environment and just overall (pfs - progression free survival)

References

- Bardia, Aditya, et al. "Sacituzumab Govitecan-Hziy in Refractory Metastatic Triple-Negative Breast Cancer." *The New England Journal of Medicine*, U.S. National Library of Medicine, 21 Feb. 2019, https://www.ncbi.nlm.nih.gov/pubmed/30786188.**(11)**
- "Breast Cancer Grades: Grading Breast Cancer." *American Cancer Society*, https://www.cancer.org/cancer/breast-cancer/understanding-a-breast-cancer-diagnosis/breast-cancer-grades.html.**(7)**
- "Breast Cancer Risk Factors." *Breastcancer.org*, 12 Aug. 2019, https://www.breastcancer.org/risk/factors. **(1)**
- "Breast Cancer Stages: 0 Through IV." *Breastcancer.org*, 23 July 2019, https://www.breastcancer.org/symptoms/diagnosis/staging#stage0.**(5)**
- "Breast Cancer Treatment | Treatment Options for Breast Cancer." *Google*, Google, https://www.google.com/amp/s/amp.cancer.org/cancer/breast-cancer/treatment.html.**(8)**
- "Breast Cancer: Breast Cancer Information & Overview." *American Cancer Society*, https://www.cancer.org/cancer/breast-cancer.html. **(0)**
- Brown, Ken. "Nutrition for Breast Cancer Patients and Survivors." *Johns Hopkins Breast Center*, 9 Jan. 2017, https://www.hopkinsmedicine.org/breast_center/treatments_services/nutrition.html. **(4)**
- "Cancer Statistics." *India Against Cancer*, http://cancerindia.org.in/cancer-statistics/. **(13)**
- "CDC - What Are the Risk Factors for Breast Cancer?" *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, https://www.cdc.gov/cancer/breast/basic_info/risk_factors.htm **(2).**
- "Eastern Mediterranean Region." *World Health Organization*, World Health Organization, http://www.emro.who.int/pse/palestine-news/gaza-patients-painful-journey-to-cancer-treatment.html. **(12)**
- Marra, Antonio, et al. "Recent Advances in Triple Negative Breast Cancer: the Immunotherapy Era." *BMC Medicine*, BioMed Central, 9 May 2019, https://www.ncbi.nlm.nih.gov/pubmed/31068190. **(10)**
- "NCI Dictionary of Cancer Terms." *National Cancer Institute*, https://www.cancer.gov/publications/dictionaries/cancer-terms/def/sequential-treatment. **(14)**
- "Receptors for Breast Cancer - Understanding Cancer - Macmillan Cancer Support." *Receptors for Breast Cancer - Understanding Cancer - Macmillan Cancer Support*, **(9)** https://www.macmillan.org.uk/information-and-support/breast-cancer/treating/treatment-decisions/understanding-your-diagnosis/receptors-for-breast-cancer.html.
- "Staging & Grade." *Staging & Grade - Breast Pathology | Johns Hopkins Pathology*, https://pathology.jhu.edu/breast/staging-grade/. **(6)**
- "What Can Cause Breast Cancer?" *Breast Cancer Now*, 2 Sept. 2019, https://breastcancernow.org/about-breast-cancer/want-to-know-about-breast-cancer/what-can-cause-breast-cancer. **(3)**
- https://www.mayoclinic.org/diseases-conditions/breast-cancer/in-depth/breast-cancer/art-20045654 **(15)**