

Mini Review

Volume 10 Issue 3 - August 2018
DOI: 10.19080/AIBM.2018.10.555786

Adv Biotech & Micro

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Inflammation and Breast Cancer



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Submission: February 15, 2018; **Published:** August 24, 2018

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Abstract

Chronic inflammation is a critical factor in tumor progression. Adipocyte accumulation and cytokines storm during inflammation have a significant impact on breast cancer. The development of cancer arises from sites of infection, chronic irritation and inflammation. Furthermore, tumor seed in tumor microenvironment as seed and soil, orchestrated by inflammatory cells, is an indispensable for cells transformed into benign or malignancy status and further fostering proliferation, survival, and migration. These insights are fostering new anti-inflammatory therapeutic approaches to cancer development.

Keywords: Breast cancer; Inflammation; Obesity; Alcohol; breastfeeding; heterogenous; chemokines; Triple Negative; Inflammation; Obesity; chronic irritation; proliferation; migration; malignancy; soil; Childbearing; protective; consumption; smoking

Abbreviations: TN: Triple Negative; IBC: Inflammatory Breast Cancer; EMT: Epithelial-to-Mesenchymal Transition; BC: Breast cancer

Introduction

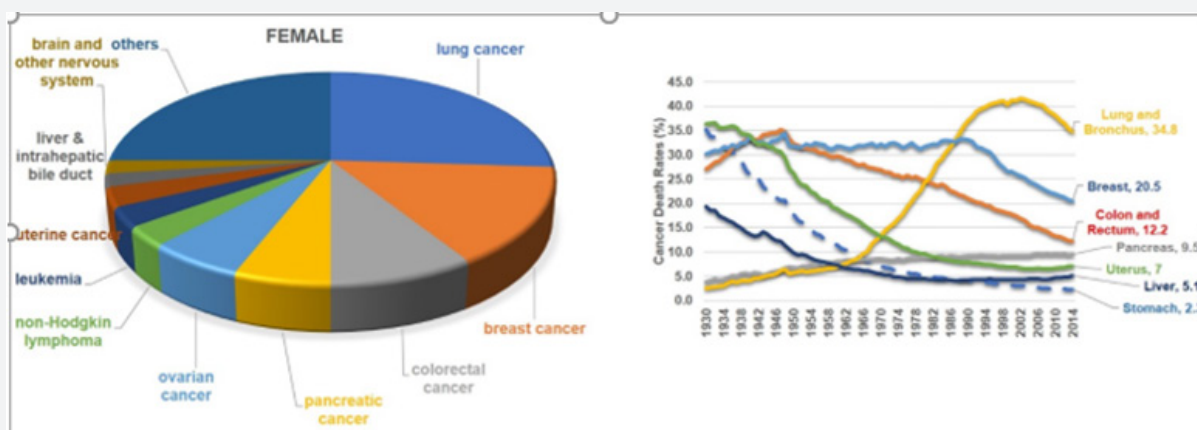


Figure 1: The overview of the proportional of different type of cancers in female.

Breast cancer (BC), the first most common malignant tumor in women worldwide (Figure 1)[1]. Many etiological factors such as a wide spectrum of clinical manifestations caused by family clustering, hormonal factors, lactation, early menarche, metabolic and secretory factors, obesity, dietary factors, alcohol consumption, smoking, and lose-dose irradiation. On top of that, obesity, alcoholism, and tobacco smoking were found to result in this incidence [2-6]. Many of the established risk factors are linked to estrogens. Risk is increased by early menarche, late menopause, and obesity in postmenopausal women, and

prospective studies have shown that high concentrations of endogenous estradiol are associated with an increase in risk[7]. Childbearing reduces risk, with greater protection for early first birth and a larger number of births; breastfeeding probably has a protective effect. Both oral contraceptives and hormonal therapy for menopause cause a small increase in breast-cancer risk, which appears to diminish once use stops. Alcohol increases risk, whereas physical activity has been suggested as protective. Mutations in certain genes greatly increase breast cancer risk, but these account for a minority of cases. The natural therapeutic

(i.e. nutritional supplements) are still discovering in progress to prevent the unnecessary aggressive procedures, although there are many FDA-approval drugs for breast cancers[8,9]. Tumors are heterogenous and individual has inherited different genetic background. Thus, it is hard to find an effective treatment and it may recurrent after recovery from first treatment.

Obesity accelerate the worse the breast cancer

The proportion of obesity has been distributed various within United State (Figure 2). Obesity is known as a key contributory factor associated with cancer risk and mortality. Obesity has resulted increase cells accumulated lipids and slowly differentiated into mature adipocytes. Study also demonstrated that adipocytes are released chemokines to attract eosinophils and monocytes which release cytokine (interleukin-4, 5, -13, and TNF α) which resulted in helminth immunity, activated macrophages associated with glucose homeostasis. Moreover, other study had demonstrated that adipocyte-associated lung neutrophilia and subsequent exacerbate the stimulatory effects

of a primary tumor on neutrophils and further enhanced metastatic seeding. Obesity produces an inflammatory state, characterized by macrophages clustered around enlarged hypertrophied, dead, and dying adipocytes from crown-like structures. There are two different type of adipocyte (white or brown). They have different metabolic demands. Due to adipocyte size and taken over the reasonable space, tissues may damage and slow recovery due to chronic inflammation damage which potentially decreases cell proliferation and increases tissue damage. This abnormal condition results in an increase in fibrous tissue and further leads to the development of cancer. Adipocytes has been suggesting as a major factor in provide as seed and soil to manipulate the microenvironments, may differentiated the normal cells toward to malignancy status (Figure 3). Thus, adipocytes may contribute significant to inflammation, immunity, extracellular matrix mechanics, epigenetic or transcriptional regulation, and protein translation in cancers[10-12].

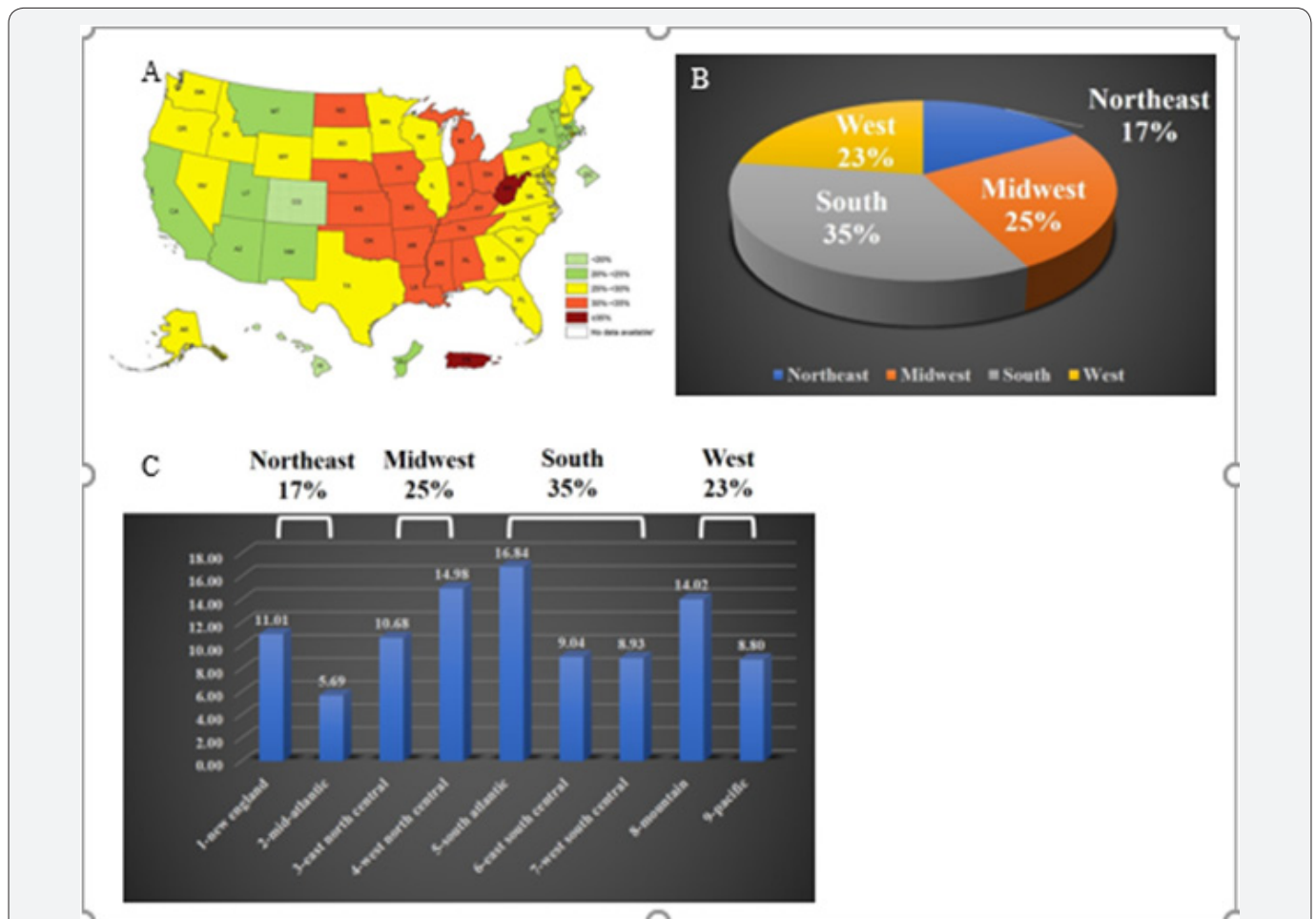


Figure 2:
 (A) Distribution of obesity within United State.
 (B) Adult obesity prevalence maps. Prevalence of self-reported obesity among non-Hispanic white adults by state and Territory.
 (C) Pie chart of 4 main regions Bar graph of the proportion of obesity within each region.

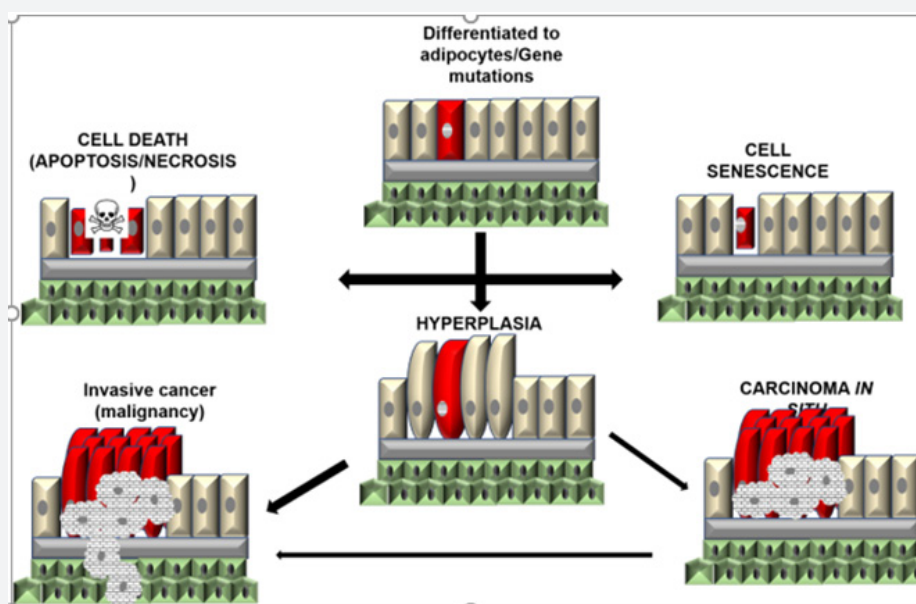


Figure 3: The process of cellular transformation into malignancy.

Moreover, Inflammatory Breast Cancer (IBC) is a rare, but aggressive type of locally advanced breast cancer. The great portion of IBC cases are also Triple Negative (TN) patients. The signs of IBC often appear faster than other type of BC, such as redness and swelling which often first treated with antibiotics. Due to the lack of breast lump and symptoms, IBC often misdiagnosis or miss the best treatment time frame. Most of patients with IBC have advanced-stage disease by the time they begin treatment. The inflammation recruits immune cells which release the cytokines and chemokines which provide seed and soil microenvironment to facilitate metastasis such as Epithelial-to-Mesenchymal Transition (EMT). Thus, it is important to increase our understanding of how IBC can be better diagnosed and how biology drives its progression which can lead to improve diagnosis, prognosis with more effective treatment for those with this aggressive disease [13-15].

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DOI: [10.19080/AIBM.2018.10.555786](https://doi.org/10.19080/AIBM.2018.10.555786)

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