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Adipose and Fatty Tissue: Increasing Tumor Activity

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This microreview is based on the increased growth of tumors in mammary tissues due to the surrounding adipose tissue. This concept is based in the cell growth in adipose tissue that leads to increased tumor rates which then is classified as aggressive breast cancer. This paper will be examining the cellular and molecular aspects of this growth of tumors in dealing with adipose tissue that is crucial in the increased cancer rate. This microenvironment promotes tumorigenesis, the growth of tumors in tissue, and is still actively discussed among medical professionals, oncologists, and physicists. Differing concentrations of adipose tissue and the cell it contains are contributors in the tumor development and aggressiveness. Along with the increased concentration, fat tissues which contain adipocytes increase the chance of tumor formation. Locating the cause of a cancer is of great importance to save lives and further our understanding of this incurable disease.

Introduction

The focus on this paper is soft adipose tissue and its effect on tumor growth and cellular replication in relation to breast cancer. There are two types of adipose tissues, brown and white. The function of the brown adipose tissue is associated with thermo control of the body, and the white adipose tissue is made up of adipocytes which are cells that secrete certain proteins assumed for the repairing of damaged tissue (Wagner et al 2012). These adipocytes are an essential part of the findings of amplifying tumors to become more aggressive and harmful. In the last few years, adipose tissue is considered an essential part and active component in the microenvironment of breast cancer. There is also extensive research being done on the effects of obesity and increased activity of the adipocyte cells. The relationship between fat cells and adipose tissue availability is also an important factor in activating the malignant tumors. Throughout this paper, there will be discussions on how adipose tissue is a key contributor in causing breast cancer.

Recent Progress

For decades, the cells adjacent to the adipose mammary tissue in breasts were considered to be harmless passive structural masses, but recent studies shown that these adipose tissues surrounding the tumorous cell are actually key components in the progression of breast cancer (Wagner et al 2012). In the past, adipose tissues were used to help repair damaged tissue in the breast after tumor removal or you can use chemotherapy or more commonly known as "lumps" (Wang et al 2012), but further research shows that adipose tissue is actually activating tumors through inflammation, making them aggressive cancer cells. These tissues drive the cancerous process into overdrive by contributing to inflammation of tissues in the nearby areas and secretion of "IL-6" protein (3). The IL-6 protein is one of the major issues in the understanding of breast cancer cells in relation to their microenvironment. Understanding what the activator in these tumors can be a major breakthrough in the knowledge surrounding breast cancer progression.

Not only are there chemical differences in the tumor environments, but the proximity of the adipose tissue also is involved. According to Dr. Emily Chandler and her associates, "at fourteen days post implantation, peritumoral adipose tissue was carefully microdissected away from the surrounding tumor mass and subcutaneouse connective tissue. Gross examination of peritumoral adipose tissue revealed an inflamed, dark reddish white mass compared to the control" (2012). So, the proximity of the adipose tissue to a tumor plays a key role in inflaming the tumor. The same study found that adipose tissues weight almost double the control group

which could be attributed to increased secretions of activating proteins, or more simply an increase in mass due to inflammation (See Figure 3).

Increased in fat cells is also a major cause of tumorigenesis. According to Marek Wagner, obese individuals have increased cancer risk due to higher levels of "pro-inflammatory factors and tissue damage" (2012). Individuals with more fat cells and have a higher percentage of adipose tissue**,** allows for more activator adipocytes to inflame tumors. This observation is demonstrated in Figure 2 in which the more obese the individual, the higher concentration of adipocyte cells which in turn leads to a higher risk of cancer. These developments in cancer understanding are important in preventing cancers such as breast cancer by decreasing the protein activators (adipocytes) to tumors.

Discussion

There are a few main points that are extraordinarily important when dealing with adipocyte cells in mature adipose tissue and tumor cells. One of the major disputes is the idea that adipocyte and cancerous cells are able to crosstalk and stimulate the cancer cells. This stimulation can have drastic effects such as tumor growth, invasion of the extracellular matrix, and radio resistance (Wagner et al 2012). All of these factors play crucial roles in the development of cancer in the mammary tissues. The invading tumors are able to modify these adipocytes, fat cells, cells in which they can turn a malignant tumor into an aggressive cancer cell simply by a small interaction (Wagner et al 2012). This communication between the cells leads to increase in mass of the adipose tissue when in close proximity to the tumor mass. This relationship between the adipocytes and the tumor are correlated by distance. As seen in Figure 3, the greater the distance between the adipocytes and the tumor, the less mass is gained by the interaction, therefore the adipocyte is has a smaller effect on the tumor.

Adipocyte concentration is also a contributing factor in the activation of tumor cells. As seen in Figure 1, the higher the concentration of adipocyte, the more active the tumor. A more active tumor simply means that it has grown to a large size based on increased inflammation due to the proteins secreted by the adipocytes. This observation and the knowledge about fat cells having pro-inflammatory cells are somewhat correlated. With higher fat cell concentration, there will be increased pro-inflammatory cells which act as a "coworker" to adipocytes cells that lead to an increase in tumor activity because of the additive inflammation.

There is still no cure or really anything close to expelling this disease from the human population, but with the knowledge obtained through these studies, there is movement in the right direction. The adipose tissue surrounding tumors secretes pro inflammatory cytokines which contributes to inflammation and promotes the aggressive phenotype in breast cancer (Wagner et al 2012). If there would be a way to possibly find an irreversible enzyme inhibitor (group specific, reaction substrate analog, or suicide inhibitor) to stop the secreting of the inflammatory substance, maybe breast cancer could be more readily managed. If experts could understand what exactly causes aggressive behavior in cancer cells, there could be a way to stop the cancer cells from growing and manipulating its surroundings so easily.

Adipose tissue is not solely located around mammary tissue in breasts, so is there a greater rate at which tumors are aggressively activated through the release of the inflammatory adipocyte (Wang et al 2012)? This is because adipocytes increased aggressiveness of a tumor. This is an interesting outlook which would require further study in order to understand to the best of our ability. Different cancer cells could be affected by adipocytes differently because each cancer varies in genetic makeup. Would there be the same activators in bone cancer as there is breast cancer? The proteins made by adipocytes could act as an activator in one type of cancer and act as in inhibitor for another. This would be worth looking into further because these different types of cancers could be completely different or very similar which could help in further understanding the chemical makeup of cancerous cells.

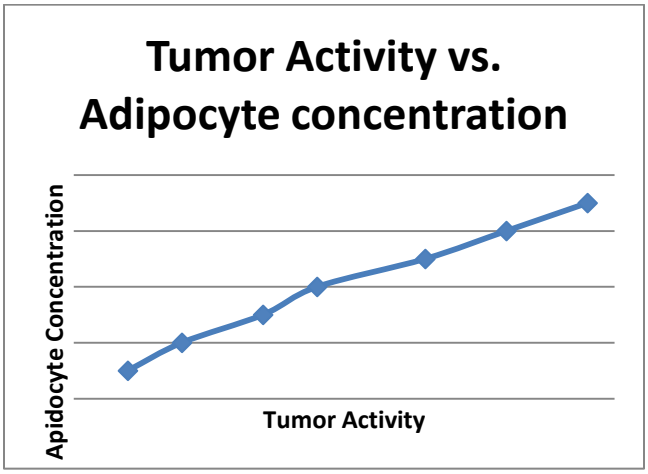

Figure 1 Tumor activity verses adipocyte concentration. This figure describes, without real data but merely the theory behind the research, how the increased levels of adipocyte cells increases tumor activity and aggression

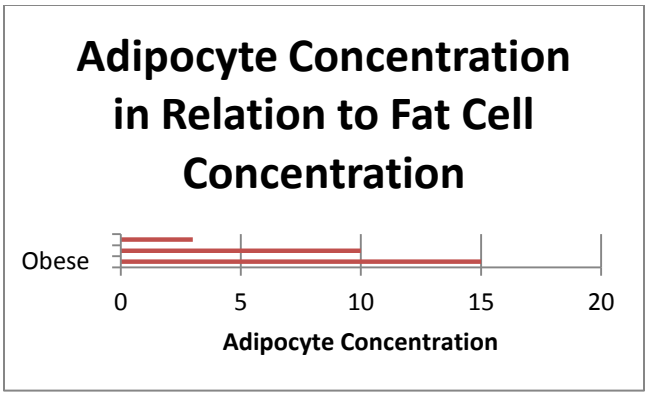

Figure 2 Data is theoretical. Fit human beings have a substantially less opportunity to have a high concentration of pro-inflammatory cells because they have fewer fat tissues. Overweight and obese individuals have a much higher fat tissue and cell content, therefore having a higher pro-inflammatory cells.

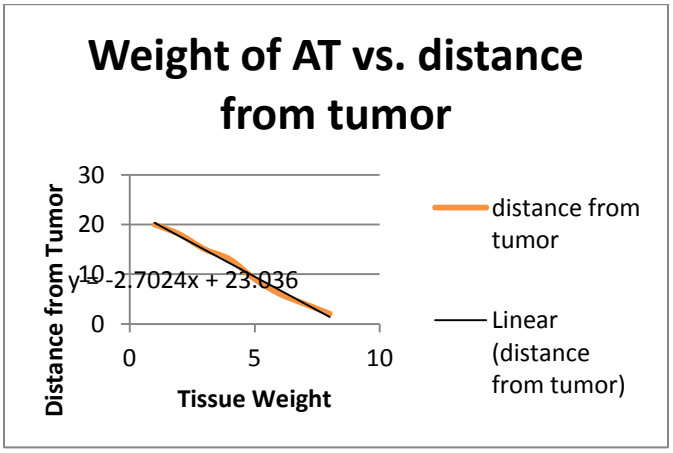

Figure 3 Data is theoretical. Increased distance of the adipose tissue to the tumor cell leads to the decreased weight gained by the adipose tissue. This explains lessened interations between the adipose tissue cells and the tumor.

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