Sample Scientific Paper

Investigating how macrophages and adipocytes influence breast cancer metastasis using the chick embryo model

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Personal Reflection

I really enjoyed my experiments with Professor Connelly and other lab workers even though it was not easy starting for me. Animal experiments were my first trial, and I didn't know how to do PCR and ELISA until I joined in Dr. Connelly's lab. I had only a slight understanding of my research topic, the progress of experiments, and data analyzing. Dr Connelly and her postdoc, Dr Tsang Mui Chung, answered all my questions and helped me make great progress in my research. I finally understand my research topic well and did my poster presentation at the JABSOM conference with confidence. I really appreciate all of the help from Dr. Connelly, the HCC lab coordinator Ms. Adams and the INBRE program for giving me a great experience.

Introduction

Obese women with breast cancer are more likely to have metastases. In adipose tissue there is an increase in macrophage recruitment. Macrophages have been shown to promote breast cancer metastasis. We believe it is the interaction between the adipocytes and the macrophages that causes the increase in metastasis seen in obese patients. Thus, we hypothesize that the interaction between adipocytes and macrophages within obese breast tissue promotes breast cancer growth and metastasis. In the current study, we aimed to prove that adding either macrophages or adipocytes to the tumor cells would increase tumor growth and metastasis.

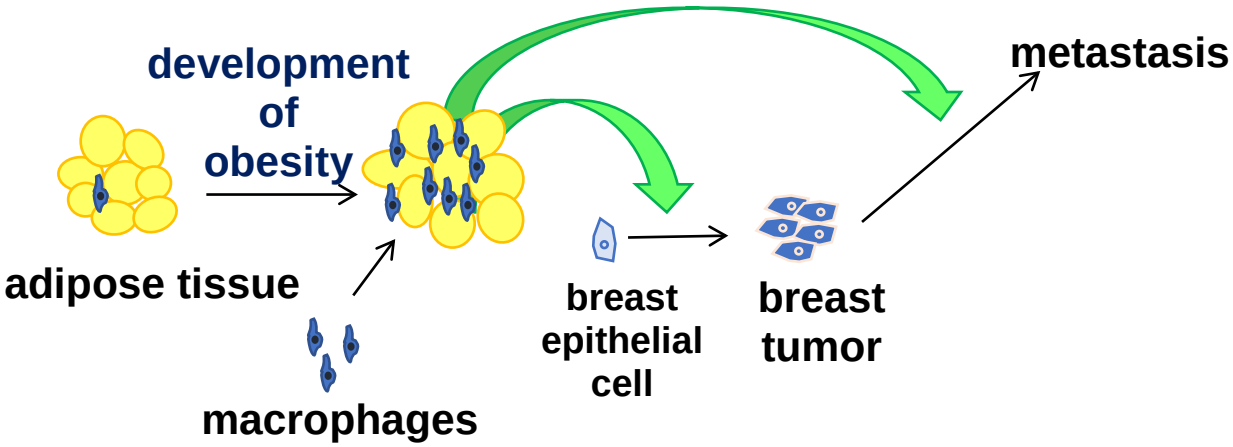

Figure 1. Diagram showing our hypothesis of how obesity promotes breast cancer development and metastasis through the interaction between adipocytes and macrophages.

Method and Materials

To test our hypothesis, we used the chick embryo model. Mouse mammary tumor cells (4T1) and murine macrophages (J774A.1) or murine adipocytes (3T3-L1) were inoculated on the chick chorioallantoic membrane (CAM) on the 10th embryonic day. The primary tumor and the chick tissues from liver, lung, and CAM contralateral to the inoculation site were harvested on the 17th embryonic day. First, we weighed primary tumors to look at effect on tumor growth. Then we fixed the tumor tissues in formalin, embedded, then looked in tissue sections for the different cell types. Finally, in order to detect metastasis, we extracted DNA from chick tissue and performed qPCR for mouse Alu sequences. A total of 4 experiments were performed: 3 for 4T1 mouse mammary tumor cells and J774A.1 mouse macrophages, 1 for 4T1 and 3T3-L1 mouse adipocytes.

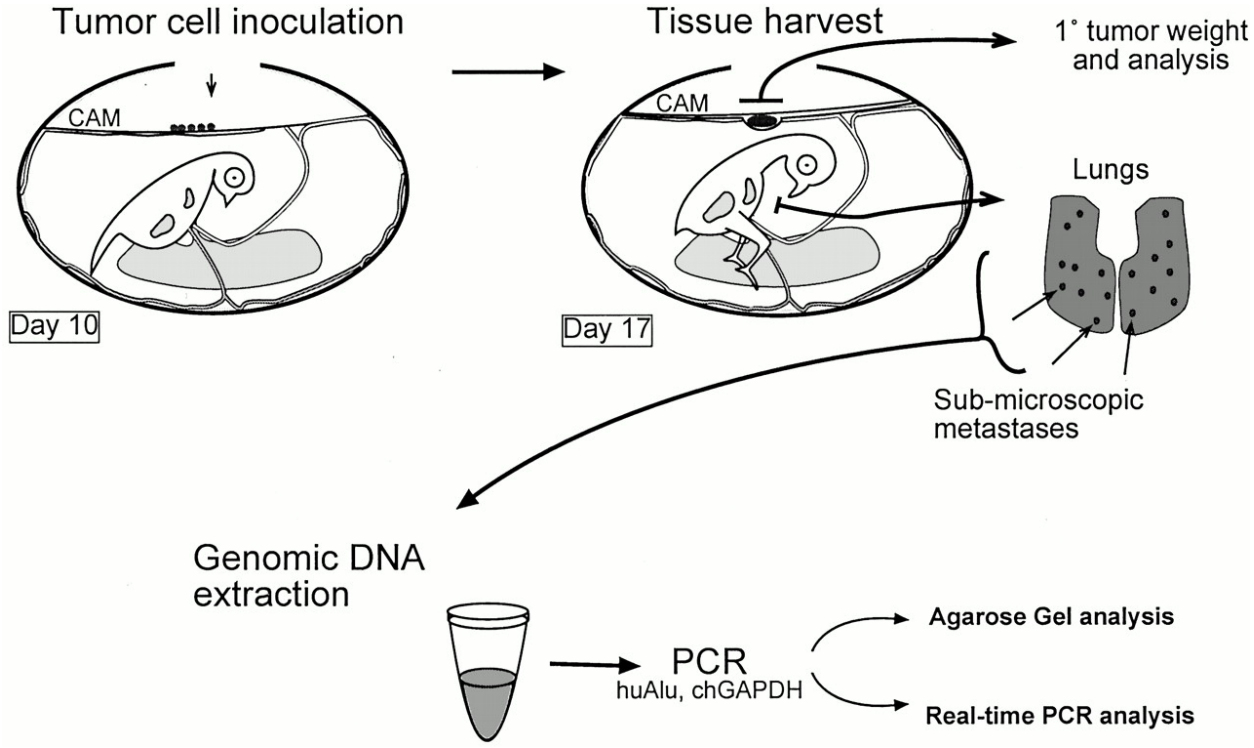

Figure 2. Diagram of the chick embryo metastasis model, taken from Zijlstra et al. 2002.

Results

The chick embryo model was developed with the J774A.1 macrophages and the 3T3 adipocytes alongside mouse mammary tumor cells. Primary tumor weights from the combination of J774A.1 macrophages and 4T1 tumor cells were greater than J774A.1 only and 4T1 only. Primary tumor weights of the combination of 3T3-L1 adipocytes and 4T1 tumor cells were greater than 3T3 only and 4T1 only. There was no difference in levels of metastasis with macrophages added. We did not have time to measure the effects of the 3T3 cells on metastasis.

Discussion

The addition of either macrophages or adipocytes resulted in growth of a larger primary tumor. Through histology, we did not detect macrophages or adipocytes in the harvested primary tumor suggesting that these cells may not survive for the whole experiment. There was a pattern of increased metastasis when macrophages or adipocytes are present compared to tumor cell only. However, the PCR data has been variable so we cannot draw conclusions yet.

In summary, we have created a model system to study the effect of cells from obese tissue on breast cancer metastasis. Further experiments are required to determine effects of macrophage and adipocyte on tumor metastasis.

References

1. Zijlstra, A., Mellor, R., Panzarella, G., Aimes R.T., Hooper, J.D., Marchenko, N.D. and Quigley, J.P. (2002) A quantitative analysis of rate-limiting steps in the metastatic cascade using human-specific real-time polymerase chain reaction. *Cancer Research* Dec;62, 7093-7092