

CAF/22/01 – A novel model of the breast cancer liver metastatic niche: tackling metastatic recurrence.

Background and Aims

Breast cancer is the most common cancer in women but despite advances in screening and treatment in the early stages, the cancer can return years later in other organs. Approximately 50% of these women will develop secondary tumours in the liver. This is associated with a limited life expectancy as their condition is no longer curable. Therefore, preventing secondary breast cancer formation in the liver is key to improving the long-term survival of breast cancer patients.

Secondary tumours result from cancer cells escaping into the blood supply during the early stages of primary cancer formation. Some of these cancer cells travel to other organs, such as the liver, where they subsequently grow to form secondary tumours. In order for the cancer cells to grow, they must first survive and then settle in their new environment. This process is known as 'metastatic colonisation' and relies on supportive signals from the liver cells. There is evidence to suggest that some cancer cells can hide in the new organ for many months or years by becoming inactive and remaining inactive until the environment is favourable for colonisation. The process of metastatic colonisation is not yet well understood but is essential in discovering ways of preventing the formation of secondary tumours.

Liver disease can be studied and new treatments tested by growing liver as 3D cultures in a laboratory dish. I will mix breast cancer cells with these liver cultures to replicate breast cancer cells that have spread to the liver in a patient. I will study the complex interactions that occur between the breast cancer cells and liver cells. I will also test chemical substances and drugs to look for treatments that could prevent breast cancer cells in the liver from forming new tumours. The model is ideal for these experiments because identical copies of it can be produced at a low cost and at a large scale, which will allow multiple substances or drugs to be tested rapidly and efficiently in one go.

My project will improve understanding of the genes and pathways that play a role in formation of secondary tumours in the liver, help discover new drugs that target the interactions between breast cancer and liver cells in order to prevent formation of secondary breast cancer in the liver. Preventing this process from occurring will have a huge impact on women with breast cancer by reducing the rates of secondary tumours and thereby improving survival.

Impact

In the short-term this research will provide information to researchers to help them understand how the liver niche supports breast cancer cells in the process of forming secondary tumours. This knowledge will be used to identify treatments for patients and will complement other studies trying to identify treatments to prevent secondary cancer. The long-term aim is to make liver tissue using patient stem cells and disperse it with the same patient's breast cancer cells. This will allow doctors to determine the best treatment option for that patient based on their cells and genes. This method of using an individual's unique genetic make-up to help make decisions about treatment of disease is known as personalised medicine.