

Fat droplets as an indicator of cell growth and death in brain tumours

Andrew Peet and Carmel McConville

School of Cancer Sciences, University of Birmingham and Oncology Department, Birmingham Children's Hospital

Background

Over the past 7 years we have been measuring fat levels in brain tumours in children and teenagers using a new type of scan called magnetic resonance spectroscopy. This is performed at the same time as the scan that is performed to diagnose the tumour. We have found that high levels of certain fats or lipids are found in more aggressive tumours and that the children with these tumours are more likely to die. Laboratory experiments using tumour tissue removed at operation and tumour cells grown in the lab show that the lipids are present in small droplets in the tumour cells (Figure 1).

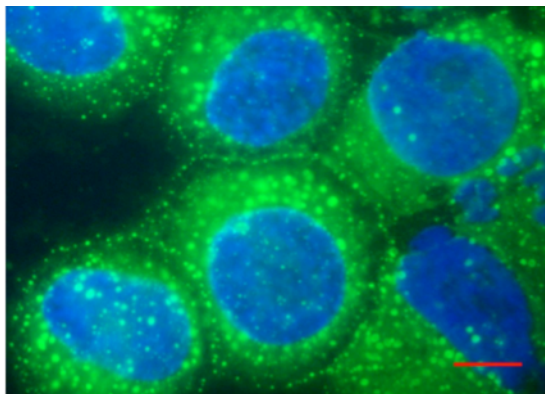


Figure 1. Brain tumour cells showing the nucleus (genetic material) in blue, surrounded by numerous lipid droplets in green.

Recent research in laboratories around the world has shown that lipid droplets are much more than just blobs of fat (Figure 2). They are surprising complex

and highly dynamic – they contain not only lipids, but dozens of different proteins and can grow and shrink, exchange proteins with their surroundings, and physically and functionally interact with other structures in the cell.

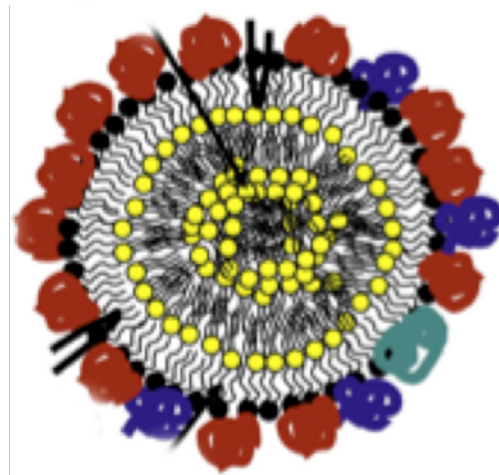


Figure 2. Lipid droplet. Lipids are shown as yellow and black dots with tails. Proteins are shown in red, blue and green.

A PhD student in our laboratory, Xaioyan Pan, has been able to isolate lipid droplets from brain tumour cells and is now working to find their composition. Interestingly, when the cells are treated with chemotherapy drugs in the lab, the number and size of the lipid droplets increase as the cells stop growing and start to die. What we do not yet know is whether their chemical composition changes as

the cells are dying. Lipid droplets are clearly of great importance to brain tumour cells and a better understanding of them may lead to new ways of treating these aggressive tumours.

Aim

The aim of this project is to determine the composition of brain tumour lipid droplets in tumour cells before and after treatment in order to understand why they are important to cell growth and death. The hope is that this will lead to new ways of treating these tumours which cannot be cured by surgery alone.

The project

We have several types of brain tumour cells growing routinely in the lab and have experience in the effects which drugs have on them. The University of Birmingham is a National Centre for laboratory based magnetic resonance spectroscopy which we will use to measure lipids isolated from the cells. A more detailed chemical analysis will be performed using mass spectrometry which is also readily available in Birmingham and within the group of a close collaborator at the University of Cambridge. The effects of drugs commonly used to treat brain tumours such as cisplatin will be determined as well as new drug not yet in clinical practice.