Potential Improvements in Whole Brain Radiation Therapy

We have often discussed on the GRACE forum the pros and cons of various approaches to address brain metastases from non-small cell lung cancer, such as whole brain radiation therapy and stereotactic radiosurgery. One concern with regard to whole brain radiation therapy is the potential long term impact on cognitive function, in particular potential reduction in skills related to short term memory, learning and multi-tasking.

Multiple lines of research evidence point towards one particular area of the brain as very important for learning and memory – the hippocampus. The hippocampus is located in the medial aspect of the temporal lobe of the brain. In the human brain, there is a right and a left hippocampus. Nearly all right handed people are left brain dominant, and the majority of left handed people are also left brain dominant – thus the left hippocampus frequently may play a stronger contributive role in cognitive function.

In studies in rats and mice, it has been shown that small doses of radiation can cause injury to brain cells in the hippocampus, whereas other areas of the brain are more resilient to that same low radiation dose and experience little or no injury. In human patients, it has been observed that patients undergoing radiation therapy treatment which involves treatment to this area of the brain have had a subsequent decline in learning and memory.

As a result of the potential benefits of avoiding the hippocampi during whole brain radiation therapy, radiation oncology investigators at Northwestern University and the University of Wisconsin have coordinated a phase II trial of hippocampal avoidance during whole brain radiation therapy through the Radiation Therapy Oncology Group (RTOG). The study number is RTOG 0933; its details are available through the RTOG website. As well on the RTOG
website, is a contouring atlas that delineates the anatomic boundaries of the relevant hippocampal anatomy as found upon cross-sectional MRI.

One practical challenge in hippocampal sparing in the context of whole brain radiation therapy relates to potential lung cancer metastases in or near the hippocampus. However, in large series of patients with brain metastases, it turns out that hippocampal metastases are extraordinarily uncommon, and metastases close (within 5mm) the hippocampal region occur in only a few percent of patients.

I am looking forward to the results of RTOG 0933, and other studies examining hippocampal avoidance during radiation therapy.