

Virtual Simulations of Brain and Cranial Base Tumors

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We are developing a system to provide a paradigm shift from passive witnessing to actively participating with information. This interactive system is for visualizing and manipulating reconstructed volumetric data sets and is being integrated for use in current surgical practice in tumor management. Through the employment of real-time interaction (15-30 frames per second) and the use of intuitive computer interfaces, this system will be instrumental in fundamentally changing the way practitioners manage medical data. Our interdisciplinary group has been collaborating over the past 18 months toward the development of this vision. Although our system is under development, we will present several interesting case studies using our current methodology.

The interactive high performance computer based system will provide for detailed visualization and manipulation of three dimensional reconstructions from magnetic resonance and computed tomography scanners. It enables a physician to more intuitively and accurately assess normal and pathologically altered patient anatomy. In this way, the physician can devise a more exact local treatment of a particular disease process (i.e. extirpation and radiation therapy of a malignant tumor). This will ultimately result in a reduction of patient morbidity and mortality as more refined treatments are devised.

This system will eventually be evaluated for its application to preoperative assessment and treatment planning of brain and cranial base tumors, an area that requires a very exact understanding of pathologically altered anatomy in order to design an approach to local treatment.

The process of developing new surgical approaches and radiation therapy delivery systems for this area is a painstakingly slow process which requires careful evolution from accepted methods to avoid patient injury. Our system when fully developed will facilitate the treating physician in obtaining a more complete understanding of the patient's pathology and enable rapid development of both minimally invasive surgical procedures and less morbid radiation treatment. Additionally, it will aide in the rapid dissemination of new techniques to other practitioners and as well as those in training. As this system meets the demands of the neurological and skull base surgeons in the treatment of brain and skull base tumors, it can be easily adapted to other areas of the body for less invasive and less morbid treatment of a wide variety of tumors. This research is consistent with medical technology development under the high performance computing initiatives for health care of the National Institutes of Health.