

RESEARCH BRIEF

MINIMALLY INVASIVE NEUROSURGICAL INTERCRANIAL ROBOT

The problem

Brain tumors, which occur in 20-40 percent of adult cancer patients, are among the most feared complications of the disease. Despite advances in treatment, prognosis is poor, with a median survival of 4-8 months. This is primarily because there isn't good continuous imaging during surgery and because the complete tumor often is not removed due to its placement and the space constraints in reaching it.

The potential

Use of magnetic resonance imaging (MRI) during surgery can supplement the surgeon's visual and tactical senses in a way that other imaging devices have not achieved, resulting in less trauma to surrounding healthy brain tissue during surgery.

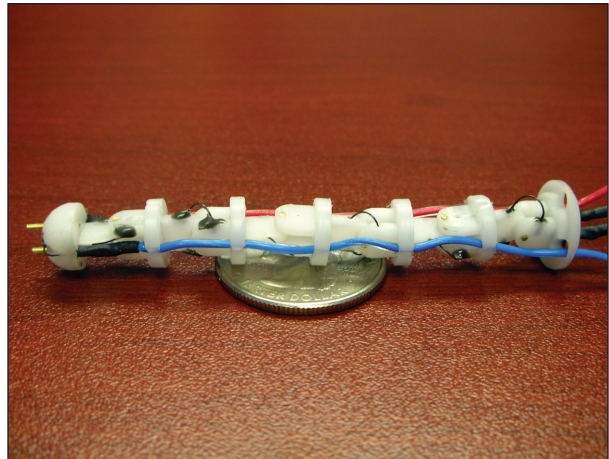
The challenge

To develop highly dexterous tools that a brain surgeon can use in conjunction with MRI imaging, improving the outcomes of surgery for patients.

The research

Professor **S.K. Gupta** (ME/ISR) and an interdisciplinary team have developed a robot that allows neurosurgeons to resect brain tumors with minimal disturbance to brain tissue. In addition to Gupta, the team includes Jaydev P. Desai (ME); Marc J. Simard, University of Baltimore Department of Neurosurgery; Rao Gullapalli, University of Baltimore Department of Radiology; and graduate students Nicholas Pappafotis and Wojciech Bejgerowski.

The robot allows a neurosurgeon to remove brain tumors and other intracranial masses in patients while they are undergoing brain imaging. The highly dexterous robot performs this function while operating through an extremely narrow corridor in the brain, with minimal disturbance and damage to normal brain tissues.



The minimally invasive neurosurgical intracranial robot allows neurosurgeons to remove a brain tumor or mass while the patient is undergoing brain imaging.

The robot is made of materials that are entirely compatible with MRI. Because the neurosurgeon directly controls the robot with a virtual interface to the MRI, he or she does not need to directly view the tumor during its removal.

The robot can manipulate instruments required to destroy tissues and remove tissue debris, including but not limited to monopolar and bipolar electrocautery, laser, radio-frequency ablator, ultrasonic cavitator, irrigation and suction. A U.S. patent application is pending.

Unique features of the robot include:

- Sufficiently small size to allow removal of tumors while the patient's brain is imaged.
- Fabrication of materials that are entirely compatible with magnetic resonance imaging.
- A virtual interface between the imaging process (MRI) and the robot that allows the neurosurgeon to conduct the surgery without having to directly visualize the tumor during its removal. The neurosurgeon has direct control of the robot guided by the imaging.
- Ability to manipulate instruments required to destroy tissues, including but not limited to monopolar and

bipolar electrocautery, laser, radio-frequency ablator
and ultrasonic cavitator

- Ability to manipulate instruments required to remove
tissue debris, including irrigation and suction

Award

2008 University of Maryland “Invention of the Year”
award in the physical science category.

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