TECHNOLOGY

MINIR: Minimally Invasive Neurosurgical Intracranial Robot

OVERVIEW

Brain tumors are the second leading cause of cancer-related deaths in children and the most feared complication of metastatic spread. The unfavorable location of many tumors, usually deep or otherwise inaccessible to conventional neurosurgical techniques, places patients at an undue risk for neurological complications from complex brain surgery. Even when the tumor is in the line of sight, white light may not be optimum to differentiate between normal and cancerous tissue for effective resection of the tumor. UMB inventors addressed this problem through the development of a highly dexterous and MRI-compatible robot, dubbed the Minimally Invasive Neurosurgical Intracranial Robot ("MINIR"). In one embodiment of the MINIR system, visualization will involve use of MRI, and all the components of the robot will be manufactured with MRI-compatible materials, which will produce minimal to no distortion in the magnetic resonance image. This will allow physicians exact teleoperative control in conjunction with MRI imaging to circumvent the difficulties in removing deep brain intracranial tumors that are typically not in the line of sight and hard to reach. In this embodiment, a plastic robot will be developed and guided by the physician based on real-time MRI images using plastic cables. The inventors are developing an entire system, including a real-time tracking and navigation system and method in conjunction with MINIR (covered under an additional technology docket #AM-2011-082)

APPLICATIONS

In 2011, approximately 22,340 new cases of primary malignant brain tumors and central nervous system tumors will be diagnosed in the United States in which 3,000 of them will be children. It is estimated that approximately $3.7 billion is spent in the United States each year on brain cancer treatment. CT and MRI are the best currently available and reproducible methods to measure target lesions and are used for neuronavigation surgeries. Leading neuronavigational system are StealthStation by Medtronic Navigation, the BrainSUITE iMRI system by BrainLAB, and Stryker's iNtellect Cranial Navigation system. However, the MINIR system is an improvement over what competitors offer in terms of its compact size and the ability to image the cranium and its contents in real time. Current systems rely on pre-rendered images taken prior to surgery and must address movement and shifting that occur during surgery. However, the MINIR system not only allows for increased precision to the physicians but allows for compensation to occur in real time as soft tissue is manipulated and extracted. In addition, due to the cost effective packaging and materials of the MINIR system, it is projected that the MINIR system will be available in a complete, low-cost package that is applicable for one-time use. Is it estimated that standard image-guided neurosurgery equipment cost as much as $500,000-$750,000. The MINIR system is projected to cost significantly less and is applicable for use wherever there is a need for precision targeting, for both neurological and non-neurological diseases.

ADVANTAGES

-Real-time MRI images during surgery allow for increased efficiency
-Minimally invasive with reduced size at entrance point
-High maneuverability due to multiple planes of movement
-Multi-functional sheath to allow multiple tools to be housed at the tip
-Composed of cost-effective materials
-Applicable for use in neurological and non-neurological diseases that require high precision and flexibility

STAGE OF DEVELOPMENT

Preliminary studies with prototype device have been conducted on gelatin brain models and pig brain.

R&D REQUIRED

Additional studies required on large animal models.

LICENSING POTENTIAL

UM seeks to develop and commercialize by an exclusive or non-exclusive license agreement and/or sponsored research with a company active in the area.

CONTACT INFO

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Additional Information

INSTITUTION

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PATENT STATUS

U.S. Patent Application pending

CATEGORIES

- Devices
- Surgical devices

INVESTIGATOR(S)

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EXTERNAL RESOURCES

- New NIH Grant to Advance Joint UMCP and UMB Brain Surgery Robot Development
- Towards a Meso-Scale SMA-Actuated MRI-Compatible Neurosurgical Robot.
- Design and Control of a 1-DOF MRI Compatible Pneumatically Actuated Robot with Long Transmission Lines.

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