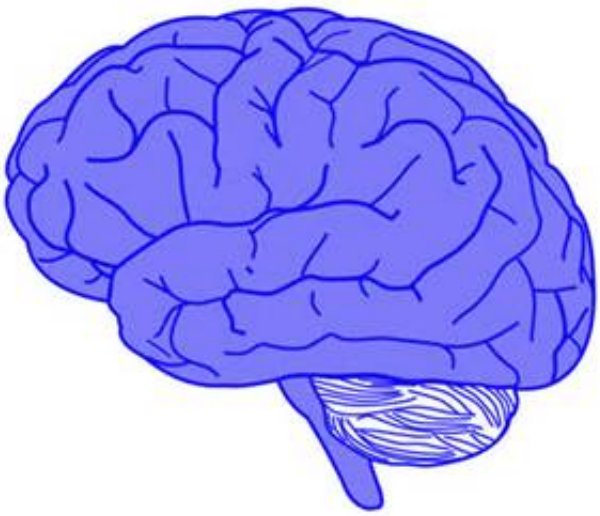
Cooling technique protects speech during brain surgery

February 25 2016



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A new cooling technique can both protect the brain's speech centers during surgery and pinpoint the areas separately responsible for word formation and speech timing. This is according to a study led by researchers from NYU Langone Medical Center and the University of Iowa published in the journal *Neuron* online Feb. 25, 2016.

Patients in the study were put under local anesthesia for an initial part of their brain operations, some of which were to remove tumors. This left

the patients awake and able to speak as part of an effort to map brain functions, including the speaking ability, to specific brain areas.

The research team showed that the combination of cooling and verbal checks during the initial mapping phase of the surgery enabled neurosurgeons to avoid speech centers when removing tissue later in the operation.

Also during the mapping phase, researchers were able to run 16 surgical patients through word exercises as the team systematically cooled 42 distinct brain sites, all in regions suggested by past studies to play roles in speech signaling. Once mapping was complete, patients received general anesthesia for the remainder of their operation.

"This study confirms that cooling is a safe and effective means of protecting important brain centers during neurosurgery," says study lead investigator Michael Long, PhD, an assistant professor in the Neuroscience Institute at NYU Langone.

All study patients safely recovered from their operation with no damage to their ability to speak, says Long. Focal cooling is a "vast improvement" over older brain-mapping techniques, he notes, which involved electrical stimulation and came with the risk of triggering epileptic seizures during surgery.

"Our study results also represent a major advance in the understanding of the roles played by the areas of the brain that enable us to form words," says Long. "When we lowered the temperature in specific brain areas during brain surgery and asked people to speak, we saw distinct and complementary roles emerge for specific brain regions."

Building on methods first used to study brain circuits that enable birds to sing, surgeons at the University of Iowa gently placed miniature devices

on patients' brains during the operations that cooled areas about the size of a quarter by as much as 10 degrees Celsius in less than a minute. This changed brain function in these spots, slowing and blurring speech as patients recited the days of the week and other simple lists. Differences corresponding to each cooled brain region were clear in recordings and confirmed by statistical analysis. Function returned to normal as each area naturally rewarmed.

Specifically, the researchers found that the speech motor cortex directs movement of the muscles, including those in the lips and tongue, which articulate words during speech. The nearby Broca's area was found to plan the actions of the speech motor cortex, including the speed and timing of muscle movements needed to form syllables.

Long says the team will next use the cooling technique to better understand how various brain regions help to interpret words. His ultimate goal, he says, is to develop therapies for people who have lost speaking ability to injury or disease.

Provided by New York University School of Medicine