Focus on Patient Care

UAB's ROSA robot guides new epilepsy procedure

by Bob Shepard

There is a new surgical robot in town. The ROSA robot is helping physicians at the **University of Alabama at Birmingham** detect the source of seizures in patients with epilepsy. ROSA offers patients, and their physicians, a unique advantage over traditional surgical approaches: it can do the job with a lot of little holes as opposed to the one very large opening that has been used up to this point.

For epilepsy patients who are interested in epilepsy surgery, determining the precise location of the area within the brain that produces abnormal electrical activity and causes seizures is the key. Once that location is pinpointed, and if it's not too close to a critical area (for speech or motor centers, for example), it can be surgically removed.

For some patients, nonsurgical investigations are sufficient to determine the area of seizure onset and allow patients to go directly to a potentially curative surgery. However, for many patients with epilepsy, the non-invasive studies do not provide enough information to proceed to surgery. For these patients, direct intracranial recording of brain activity, specifically seizure activity, is required.

In order to perform direct intracranial recording, the patient undergoes an operation to place electrodes directly on the brain or within the brain. This allows for electroencephalography, or EEG, to record electrical activity in the brain. For intracranial EEG, the traditional approach has been for the surgeon to perform a craniotomy, in which they remove a large section of the patient's skull, and then lay a grid of electrodes directly on the brain.

The electrodes remain in place for up to two weeks while the patient resides in a seizure monitoring unit. As seizures occur, the corresponding electrical activity is noted, and epilepsy physicians can determine if surgery is an option, and if so, where to cut. But, having a large piece of skull removed for several weeks is a very invasive surgery. It can be painful and uncomfortable, and carries risks including a risk of infection.

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There is another way, long used in Europe but only recently approved for use in the United States. It is called stereotactic EEG, or sEEG, and it does away with the craniotomy in favor of multiple small holes — called burr holes — drilled into the skull. Electrodes are then threaded through the holes and placed in areas that are suspected to produce the disabling seizures.

"Instead of using this very invasive procedure requiring a craniotomy and exposing the brain, we can drill small burr holes in a skull and place the electrodes directly inside the brain," said Jerzy Szaflarski, M.D., Ph.D., professor in the **Department of Neurology** and director of the **UAB Epilepsy Center**. "Over the past few years we have learned that sEEG provides a much less invasive approach and we have implemented this approach at UAB in 2013."

And UAB is one of the first U.S. hospitals to obtain the ROSA robot, produced by **Medtech**. ROSA, which the company calls 'a reliable and accurate surgical assistant', fine tunes the sEEG process. Using standard scalp EEG and MRI images, the team first maps the region of the brain where the seizure locus is suspected to lie. The optimal positioning of the electrodes to confirm the seizure locus is plotted. ROSA, which works in three dimensions, aids in the precise placement of the electrodes.

"The ROSA robot allows us to very safely, efficiently and precisely place the sEEG electrodes," said Kristen Riley, M.D., associate professor in the **Department of Neurosurgery**. "With the robot, we can efficiently move from one electrode trajectory to the next. The robotic precision tracks multiple trajectories, ensuring that each electrode is placed in the safest, most optimal position."

ROSA's robotic arm unerringly moves to each pre-plotted point. The surgeon drills into the skull and secures an anchor bolt. The electrode is then fed to the desired depth and its leads are connected to a monitor. ROSA then moves to the next position and the process is repeated.

ROSA allows for the placement of numerous arrays of electrodes, including bilateral placements, each with multiple contacts, at varying depths in the brain. This provides for much more complete coverage and a more accurate determination of the seizure locus.

"sEEG is a much less invasive procedure than the craniotomy with subdural grid procedure," said Riley. "From a patient standpoint, sEEG causes much less discomfort. While it is still a surgical procedure, there is less pain, less discomfort, and patients are much more comfortable in the seizure monitoring unit with the stereo EEG electrodes in place.

Riley and Szaflarski say that the complication profile for sEEG is far less than that of the craniotomy/subdural grid approach.

"We see a lot of potential in the sEEG procedure," Szaflarski said. "We are still exploring the full capabilities of this approach and we are gradually moving to implement sEEG on a regular basis."

The UAB Epilepsy Center is one of the largest and most active in the nation and the only one in Alabama. It is a Level 4 Center, the highest designation from the National Association of Epilepsy Centers. The center has the capability to diagnose and treat epilepsy using the latest and most current medical and surgical techniques available anywhere in the world.

"We have the full gamut of epilepsy therapies available at UAB, but we are constantly in search of new and improved treatments," said Szaflarski. "Currently available therapies work well in approximately 60-70 percent of patients."