Investigating Robotic Neurointerventions with an Eye Toward Remote Stroke Treatment

The timeliness of treatment plays such a large role in determining outcomes for stroke patients that travel time to an adequately equipped and staffed medical center can become highly problematic, particularly outside of urban centers. Remotely controlled robotic interventions could help reduce the heavy toll exacted each year by delayed stroke treatment, but there is much work to be done in laying the groundwork for this technological solution.

Robotic control for neurointerventional procedures can offer advantages over manual control even when there is no need for the procedure to be performed remotely. When operating the controls of a robot, the neurointerventionalist can work from a safe location, away from possible radiation exposure and freed from the need to wear lead protection. Robotic control may even prove to have value for interventional radiologists who are learning procedures that are new to them by providing an enhanced margin of safety in how they manipulate their tools and devices. Researchers are also looking into ways to add a layer of artificial intelligence to help operators navigate complex three-dimensional anatomy and to further enhance the safety and efficiency of using a robot for these procedures.

“The robot may have benefits because of greater fine control over the movement of the devices. Using joystick controls and having geared mechanisms, you can do various incremental movements potentially more accurately than with manual control,” says Gary Duckwiler, MD, professor of radiology and neurosurgery, and chief and fellowship director of the Division of Interventional Neuroradiology. “But the huge potential for this is in determining if we can do remote work with the robot.”

The robot that is currently available and FDA approved for neurointerventional procedures is being used for diagnostic cerebral angiography and carotid stenting, which can be done utilizing a single catheter. “Driving one catheter up requires a certain number of gears and channels; driving two catheters up requires additional gears and channels,” explains Dr. Duckwiler. “Ultimately, to do a full stroke case will require multiple channels, and that capability is not currently available, though it is under development.”

UCLA currently has the single-catheter robot installed in its clinical angiography suite and has begun using it in patient care. A second, dual-catheter robot will soon be installed in UCLA’s...
Catheter manipulation using a push-pull and rotation joystick control solely based on the visual information.