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## Neurorobotics in Pakistan

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## EDITORIAL

# NEURO-ROBOTICS IN PAKISTAN

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### Neuro-robotics

Neurosurgery demands highest degree of accuracy and precision. A surgeon's dexterity may be tested to the human limit when it comes to negotiating with delicate structures inside cranial cavity. Robotic devices can help surgeons cross these human limits and achieve better precision and less invasiveness. With enhanced accuracy, precision and dexterity it is possible to work through small corridors and trajectories causing minimal injury to the normal brain. Unfortunately however, robotics in neurosurgery is not as advanced as it is in other surgical specialties like gynecology and urology.

Several neurobotic systems have been introduced<sup>1</sup>. Most popular use of neuro robotics in neurosurgery is Cyberknife (Accuray, Sunnyvale, California). Cyberknife is a robotic stereotactic radiation system used for stereotactic radiosurgery. It is frequently being used for the treatment of different tumors and vascular malformations. Developing robots to perform microsurgery is a much bigger challenge.

Medical robots are classified as either Active or Passive. Active robots are programmed to sense and react to environment. While the passive robot is controlled by surgeon's input to the device. NeuroArm developed by University of Calgary is one the most sophisticated neuro robotic device with a master slave program performing delicate neurosurgical tasks controlled by a surgeon<sup>2</sup>. This has special application in minimally invasive neurosurgery. Similar systems are being developed in other places like Japan. These robots are able to perform tasks as complex as suturing blood vessels. Still a lot is to be done before they are employed on actual patients.

Another variety of robots is of semi active devices that provide some guidance to surgeons in performing a procedure. One example is NeuroMate (Renishaw Inc, Wotton-under-Edge Gloucestershire, United Kingdom) used in stereotactic surgery<sup>3</sup>. The use of robotic technology is expected to grow rapidly in the coming years.

### Current Status of Neuro-robotics in Pakistan

Technological gap between developed world and developing countries is huge. Yet Pakistan is with some individual efforts has made progress in fields as advanced as neuro robotics. In the form of Cyber Knife, robotic technology has been in use in Pakistan at the Jinnah Postgraduate Medical Center since December, 2012. Cyber Knife has significantly contributed to patients requiring radiosurgery. This robotic device is not used in actual surgery; this is to deliver precise radiation. For robotic use during the surgical procedure, there are few available now. A couple of them have been mentioned above and another one is recently acquired by the Aga Khan University.

With the help of large donations the Aga Khan University was able to install Brightmatter™ (Synaptive Medical) a semi active robotic device that guides neurosurgeons in planning and the executing a safe and less invasive surgery. The system is a combination of advanced neuronavigation and exoscopy (a magnified view of the operative field projected out on a screen). Navigation is based on special magnetic resonance imaging sequences of the brain. This provides information on the location of lesion in relation to white matter tracts and brain parenchyma. Based on this information site and trajectory of surgical approach is planned. During surgery the robotic arm controlled by through a computer program aligns itself to the line of surgical view. The exoscope projects magnified views of the operative field on to a large screen. The assistant thus shares the same view. The distance of surgical area from vital white matter and cortex can be assessed at any time during surgery by the use of navigation probe. The first using the system was performed in April 2016 at the Aga Khan University Hospital Karachi. Since then over 70 cases have been performed with satisfactory results.

These are the only examples robotics used in the treatment of patients in Pakistan. To keep pace with modern world and provide our patients with better treatment options, other medical centers need to look at the future and invest in technology too.

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