Frameless Stereotactic Robot Assistance in Epilepsy Surgery: Preliminary Results

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Introduction

Robotic surgery is utilized in general surgery and urology. Its utility in neurosurgery is still poorly explored. Invasive monitoring using stereotactic implantation of depth electrodes (a.k.a. stereo-electroencephalography, or SEEG) is a promising method of invasive monitoring for refractory epilepsy. Electrode trajectories using standard approaches are limited to a confined area of implantation with further limitations for oblique trajectories. We are reporting our initial experience using a robotic device in the placement of depth electrodes in invasive monitoring for refractory focal epilepsy.

Methods

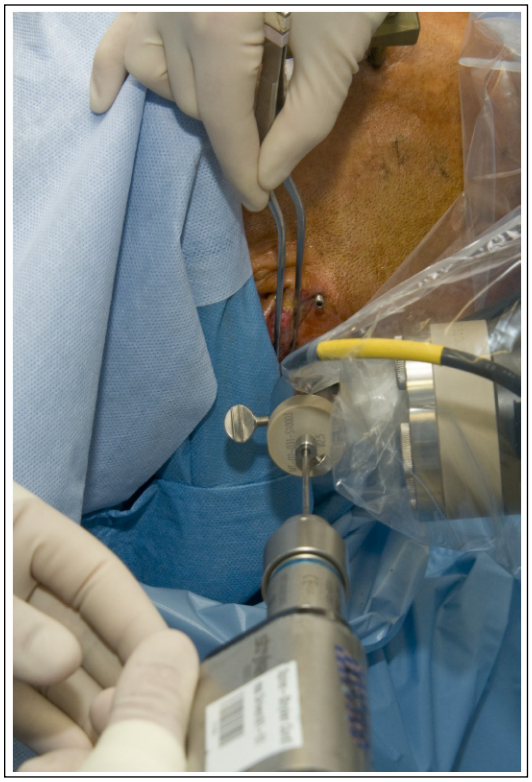
We utilized ROSA® (Medtech, Montpellier, France) to assist with the SEEG implantation for four patients. Indications for depth electrode placement included the need for bilateral hemispheric exploration, inconsistency of non-invasive data and/or suspicious of early involvement of eloquent cortex. Patients underwent a stereotactic preoperative MRI, from which trajectories were planned. Demographics, type of seizures, fluoroscopy time, complications and seizures outcome were prospectively collected.

Results

Patient ages were 50, 34, 20, and 32 years. Patients were implanted with 13, 14, 14, and 13 depth electrodes, respectively (total of 54 electrodes). Electrodes were placed in orthogonal and oblique trajectories, in both hemispheres. Three patients underwent implantation in dedicated biplane fluoroscopy suite. The fourth was implanted using portable fluoroscopy. Electrode implantation times were 111, 132, 175, and 162 minutes. Fluoroscopy time was dramatically less when compared with standard placement (less than 3 minutes versus 10 minutes). Targeting accuracy was consistent with that obtained using the standard approach. No permanent complications occurred.

Conclusions

Robotic assisted technique represents an opportunity to decrease radiation exposure, to reduce operative time and cerebral angiogram complications, to minimize patient time under general anesthesia, and to implant trajectories not accessible with a framed system. Our initial experience with the use of ROSA indicates that robotic assistance provides a potential platform for increasing the safety and feasibility of SEEG procedures.



Learning Objectives

To understand indications for invasive monitoring in refractory focal epilepsy.

To understand the utility of robotic assistant devices in epilepsy surgery

References

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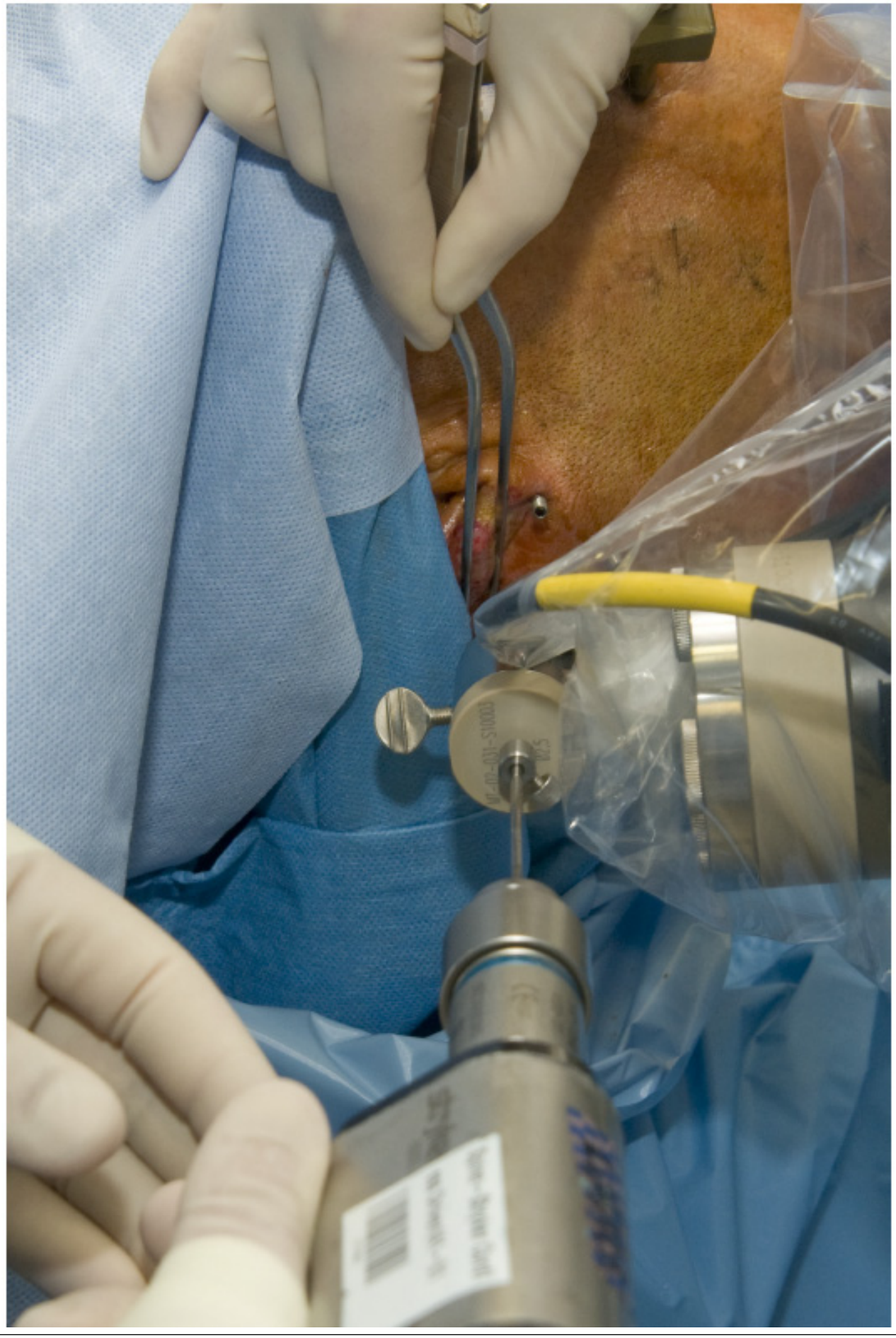


ROSA