ROSA™ robotic device

ROSA™ robotic device from Medtech.

The use of frameless stereotactic robotic technology has rapidly expanded since the Food and Drug Administration's approval of the Robotic Surgical Assistant (ROSA™) in 2012. Although the safety and accuracy of the ROSA platform has been well-established, the introduction of complex robotic technology into an existing surgical practice poses technical and logistical challenges particular to a given institution.

To better facilitate the integration of new surgical equipment into the armamentarium of a thriving pediatric neurosurgery practice by describing the use of a three-dimensional (3D)-printed patient model with in situ 3D-printed tumor for presurgical positioning and trajectory optimization in the stereotactic biopsy of a pontine lesion in a pediatric patient.

A 3D model was created with an added silicone mock tumor at the anatomical position of the lesion. In a preoperative rehearsal session, the patient model was pinned and registered using the ROSA platform, and a mock biopsy was performed targeting the in Situ silicone tumor.

Utilization of the 3D-printed model enabled workflow optimization and increased staff familiarity with the logistics of the robotic technology. Biopsy trajectory successfully reached intralesional tissue on the 3D-printed model. The rehearsal maneuvers decreased operative and intubation time for the patient and improved operative staff familiarity with the robotic setup.

Use of a 3D-printed patient model enhanced presurgical positioning and trajectory planning in the biopsy of a difficult to reach pontine lesion in a pediatric patient. The ROSA rehearsal decreased operative time and increased staff familiarity with a new complex surgical equipment [1].

Indications

Biopsy

100 frameless robotic biopsies using a Medtech ROSA device was retrospectively analyzed.

A stereotactic biopsy was performed in 84 by frameless robotic surface registration, 7 were performed by robotic bone fiducial marker registration, and 9 were performed by scalp fiducial marker registration. Intraoperative flat-panel CT scanning was performed concomitantly in 25 cases.

A histological diagnosis was established in 97 patients. No deaths or permanent morbidity related to surgery were observed. Six patients experienced transient neurological worsening. Six cases of bleeding within the lesion or along the biopsy trajectory were observed on postoperative CT scans but were associated with transient clinical symptoms in only 2 cases. Stereotactic surgery was performed with patients in the supine position in 93 cases and in the prone position in 7 cases. The use of fiducial markers was reserved for posterior fossa biopsy via a transcerebellar approach, via an occipital approach, or for pediatric biopsy.

ROSA frameless stereotactic biopsies appear to be accurate and safe robotized frameless procedures [2].

Pedicle screw placement

The ROSA® Spine robot enables accurate pedicle screw placement. Thanks to its robotic arm and navigation abilities, the robot monitors movements of the spine throughout the entire surgical procedure and thus enables accurate, safe arthrodesis for the treatment of degenerative lumbar disc diseases, exactly as planned by the surgeon. Development perspectives include (i) assistance at all levels of the spine, (ii) improved planning abilities (virtualization of the entire surgical procedure) and (iii) use for almost any percutaneous spinal procedures not limited in screw positioning such as percutaneous endoscopic lumbar discectomy, intracorporeal implant positioning, over te top laminectomy or radiofrequency ablation [3].

Case series

2017

In the Department of Neurosurgery, Washington University School of Medicine in St. Louis, Missouri, Seventeen patients underwent 23 procedures using the ROSA system. A total of 87 electroencephalography electrodes were placed, with 13% deviating more than 3 mm from target. Six patients underwent stereotactic needle biopsy, and 9 underwent laser interstitial thermotherapy (LITT). One patient who underwent LITT required a subsequent craniotomy for tumor resection. Another patient experienced an asymptomatic extraaxial hematoma that spontaneously resolved. No patient suffered neurological complications during follow-up. Follow-up from the last procedure averaged 180 days in epilepsy patients and 309 days in oncology patients.

The precision, ease of use, and versatility of the ROSA system make it well suited for pediatric neurosurgical practice. Further work, including long-term analysis of results and cost-effectiveness, will help determine the utility of this system and if its applications can be expanded [4].

1)
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