Neurosurgical Forum
LETTERS TO THE EDITOR

**Boltless
stereoelectroencephalography:
a necessity in very young children**

TO THE EDITOR: We read with interest the article by Karsonovich et al.¹ (Karsonovich T, Alexander A, Graber S, O'Neill BR. Placement of leads for stereotactic electroencephalography without the use of anchor bolts: technical note. *J Neurosurg Pediatr*. 2021;27(3):253–258).

We congratulate the authors for this innovative technique of implanting stereoelectroencephalography (SEEG) electrodes in pediatric patients, especially in very young children. The epileptogenic zone (EZ), in line with the concept proposed by Talairach and Bancaud, relates to the exact site of seizure origin in the 3D brain space. Therefore, the aim of invasive evaluation should be to isolate the area of seizure onset.² Recently, SEEG electrodes have gained popularity in the majority of the centers specialized in epilepsy care across the globe. Placement of these electrodes can be either frame based or frameless (using robotic systems). The literature is replete with reports of various studies demonstrating equivalent accuracy and safety of both frame-based and robotic systems. Surgeries demanding high precision, such as deep brain stimulation and radiofrequency lesioning of deep-seated pathologies, are increasingly being performed under robotic guidance.^{3–6}

The placement of SEEG electrodes in very young children as part of comprehensive evaluation of the EZ remains a significant challenge, especially when the EZ has not been localized even after the performance of a battery of noninvasive investigations. Robot-guided placement of SEEG electrodes is preferable to frame-based methods in pediatric patients, due to the following reasons: 1) thin bone may preclude the placement of a stereotactic frame (especially in children younger than 2 years of age with bone thickness less than 2 mm) and 2) robotic guidance may shorten the duration of surgery, with consequent reduced exposure to general anesthesia.

Therefore, in situations with either bone thickness of less than 2 mm or absent bone owing to postcraniotomy bone loss, placement of SEEG electrodes can be performed using robotic guidance, thereby avoiding the stereotactic frame. The other important concern of anchor bolt placement can be circumvented by placing the SEEG leads directly anchoring to the scalp without bolts. However, the accuracy of placement might be compromised by

doing so. To increase the placement accuracy, the authors have used a split cannula instead of an anchor bolt to guide the SEEG lead along the desired trajectory. In addition, we suggest that the passage of a metallic stylet prior to the insertion of the SEEG electrode would enhance the accuracy of placement. We also are of the opinion that, apart from creating a track using a metallic stylet, insertion of stiffer electrodes with the stylet may ensure precise placement of the SEEG leads. The precision of SEEG placement is of extreme importance, not only for the purpose of localization of the EZ, but also when lesioning of the EZ is contemplated. Therefore, further validation regarding the safety and efficacy of this technique involving multiple centers is anticipated in the future.

Ramesh Sharanappa Doddamani, MCh
Raghu Samala, MCh
P. Sarat Chandra, MCh
Manjari Tripathi, DM

All India Institute of Medical Sciences and
Centre of Excellence for Epilepsy, New Delhi, India

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Disclosures

The authors report no conflict of interest.

Correspondence

Ramesh Sharanappa Doddamani: drsdramesh@gmail.com.

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Response

We thank Dr. Doddamani and colleagues for their kind words and thoughtful consideration of our article.

We certainly agree that SEEG can be an important tool in localizing the epileptogenic zone, even in very young children. Our feeling is that the boltless electrode placement technique described in our article is safer when placing the electrode through thin bone as this method eliminates the possibility of the bolt toggling or plunging. The degree of accuracy which we found in systematic review of this technique is encouraging, but more experience is required to fully evaluate the complication profile. Since the publication of our article, we have continued to use this technique without resulting patient complications.

We were somewhat surprised in this study by how commonly excessively thin bone was encountered in the squamous region of the temporal bone of older children and even teenagers. This region is an important implant site given the ubiquity of temporal lobe seizures in the epilepsy surgery population. Additionally, this technique can be valuable when planning trajectories in pediatric or adult patients who have undergone prior surgeries and have bony defects near the implantation zone.

Regarding the question of using a more rigid SEEG electrode for the boltless leads, this possibility is intriguing, but such a product is not (to our knowledge) available.

Luckily, we have not seen any evidence on postoperative scans that these boltless leads deflect away from a straight trajectory, and we have also not had any delayed postoperative hemorrhages from mobility in these leads.

A persistent challenge in performing SEEG in young patients with a thin, malleable skull is the need for rigid head fixation, which is required even with robotic techniques. All of the pin-based skull fixation systems pose a risk of puncturing the skull, potentially causing injury. There is additional risk, particularly with non-pin fixation systems, of pressure of the clamp deforming the head, which could decrease the accuracy of stereotaxy planned on preoperative scans. Our solution has been to use pin-based fixation with lower pressure and pins placed in thicker areas of the bone. This procedure does require extra care to avoid shifting of the head with surgical maneuvers.

Brent R. O'Neill, MD

Allyson Alexander, MD, PhD

Children's Hospital of Colorado, Aurora, CO

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