

Editorial

Pediatric EEG and the COVID-19 Pandemic: Can We Develop a Safe Transition Pathway to Reopen Our Laboratories?

Jorge Vidaurre¹ Monica P. Islam¹ John R. Mytinger¹

¹Department of Pediatrics, Division of Pediatric Neurology, Nationwide Children's Hospital, and The Ohio State University, Columbus, Ohio, United States

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Although epilepsy is a clinical diagnosis, routine electroencephalography (EEG) data can aid in the determination of seizure/epilepsy type. According to the current International League Against Epilepsy definition, epileptiform abnormalities can contribute importantly to the diagnosis of epilepsy even following a single unprovoked seizure.¹ The COVID-19 pandemic and the mandated community mitigation strategies (e.g., physical distancing) used to protect vulnerable populations and to slow disease transmission² have profoundly impacted our ability to perform EEG. Given the close contact and prolonged exposure to patients with unknown COVID-19 status, the safety of EEG technicians is of paramount importance. Within this editorial, we review our strategy to reopen our EEG laboratory as we concentrate on technician, patient, and community safety.

Nationwide Children's Hospital is a large freestanding academic pediatric hospital in Columbus, Ohio with a high volume of routine EEGs performed daily. With the initial rise in confirmed COVID-19 infections in the state, our EEG laboratory transitioned abruptly to perform only emergent (inpatient only) and urgent (outpatient) EEGs such as in cases of suspected status epilepticus, altered mental status of unknown etiology, possible new-onset seizures that could not be confirmed clinically, and suspected infantile spasms. The guidance to close and the initiative to reopen have been directed by the institution and directives from the state government regarding elective procedures and stay-at-home orders. National societies such as the American Clinical Neurophysiology Society have provided resources and the advice regarding the pediatric studies which are particularly limited. We seek to develop a transitional guideline as we reopen our EEG laboratory, a pediatric EEG laboratory, with the following recommendations to optimize safety.

In regard to the technician safety, we consider the following:

1. Technicians are in close contact for prolonged periods with patients of unknown COVID-19 status. Even one parent/guardian accompanying a minor places a minimum of three individuals within the confines of a room and challenges efforts to maintain 6 feet of distancing.
2. COVID-19 most often spreads via respiratory droplets from person to person during close exposure.³ Poorly cooperative children may cry or spit, emitting droplets during the hook up, in the course of the duration of test and removal of electrodes. Additionally, the use of pressurized air to affix electrodes may contribute to aerosolization.
3. The rate of asymptomatic COVID-19 infection is unknown but is known to occur.
4. Technicians have minimal experience in the use and disposal of personal protective equipment (PPE).
5. For multiple EEG technicians, older age and pre-existing medical conditions place them at greater risk of morbidity and mortality related to COVID-19.⁴

In regard to patient safety, we consider the following:

1. For some patients, an urgent outpatient EEG (with the availability to schedule with a rapid turnaround) provides a high-yield information sufficient to guide immediate management while avoiding unnecessary COVID-19 exposures in the emergency room and inpatient settings.
2. The location of the EEG laboratory (on a shared inpatient floor or in an outpatient center) impacts the extent and consequences of exposures.

Considerations for transitional guidelines include:

1. Only perform urgent studies during the transition: The ordering neurologist determines the designation of "urgent." If the test is ordered by the primary care

Address for correspondence

Jorge Vidaurre, MD, Department of Pediatrics, Division of Pediatric Neurology, The Ohio State University, Columbus, OH 43205, United States
(e-mail: Jorge.Vidaurre@nationwidechildrens.org).

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provider, the director of the EEG laboratory will review the referral for urgency. The ordering provider may have insight into not only medical history but also social factors that would impact a family's likelihood to seek emergency care if the study is not completed. Guidance for urgent studies may include (but is not restricted to):

- A. Suspected seizures that cannot be confirmed clinically.
 - B. New onset epilepsy in which the EEG is critical to inform medication management.
 - C. Suspected infantile spasms.
2. Where available: Patients scheduled for urgent (nonemergent) studies will undergo COVID-19 testing within 24 hours prior to the EEG. Urgent EEGs for COVID-19 positive patients will be deferred; emergent EEGs should be considered for completion even with a positive test result and with a higher degree of PPE (respirator rather than surgical mask). Given the emergent need for the treatment of new-onset infantile spasms, pretesting for COVID-19 is appropriate only if same-day rapid testing is available.
 3. Technicians will be trained on the use of PPE and utilize it on every patient (surgical mask, goggles, gloves, and gown).
 4. To minimize the potential for aerosolization from use of pressurized air, consider using paste and tape rather than collodion. If not already in use, consider using disposable electrodes.
 5. Technicians >60 years old and those with pre-existing medical conditions which increase the risk of severe illness should perform duties that minimize risk (e.g., alternative job responsibilities, performance of EEG in confirmed COVID-19 negative patients).
 6. Patients and a single accompanying adult should wear a surgical mask during the EEG. We recognize that this may be challenging in very young children. The Centers for Disease Control and Prevention (CDC) recommended avoidance of masks in children under 2 years of age; however, masking during the time the patient is in the EEG laboratory occurs for a short period of time and under close supervision.
 7. Hyperventilation procedures should be performed only in confirmed COVID-19 negative patients. This can be completed with transient unmasking and with the parent

(rather than the technician) holding a pinwheel for the child to blow. When COVID-19 testing prior to EEG is not available, hyperventilation should be performed only when absence seizures are suspected.

Communication among technicians, families, neurologists, and primary care providers in this rapidly changing environment is paramount. We consider the pre-EEG COVID-19 test a necessary procedure, but we recognize that testing may not be available for all laboratories and that nasopharyngeal swabbing may cause additional procedural anxiety in some children. The prolonged postponement of nonurgent EEGs has the potential to affect patient care in many ways. Local patterns of COVID-19 spread, especially as community isolation measures begin to relax, will need to be considered carefully in determining when to schedule outpatient EEGs more liberally and when to discontinue the practice of pre-EEG COVID-19 testing. Regarding the adjustments each institution adopts such as the prioritization of studies, use of PPE, and pre-EEG COVID-19 testing, continued vigilance to the changing public health situation will guide the implementation or modification of this proposed guideline.

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Conflict of Interest
None declared.

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