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Optimizing the operation of an electrodiagnostic laboratory during the COVID-19 pandemic: A 6-month single-center experience

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Abstract

Introduction/Aims: The initial surge of the coronavirus disease-2019 (COVID-19) pandemic in early 2020 led to widespread cancellation of elective medical procedures in the United States, including nonurgent outpatient and inpatient electrodiagnostic (EDx) studies. As certain regions later showed a downtrend in daily new cases, EDx laboratories have reopened under the guidance of the American Association of Neuromuscular & Electrodiagnostic Medicine (AANEM). In our reopening experience guided by the AANEM, we measured relevant outcomes to determine further workflow adaptations. We aimed to detail our experience and share the lessons learned.

Methods: We reviewed the clinical volumes, billing data, diagnosis distributions, and rates of COVID-19 exposure and transmission among patients and staff in our EDx laboratory during the first 6 months of reopening, starting on June 1, 2020. For context, we detailed the recent AANEM guidelines we adopted at our laboratory, supplemented by other consensus statements.

Results: We completed 816 outpatient studies from June 1 to December 1, 2020, reaching 97% of the total volume and 97% of total billing compared with the same time period in 2019. The average relative value units per study were similar. There were no major shifts in diagnosis distributions. We completed 10 of 12 requested

inpatient studies during this period. There were no known COVID-19 transmissions between patients and staff.

Discussion: Our experience suggests that it is possible to safely operate an EDx laboratory under the guidance of the AANEM and other experts, with clinical volume and billing rates comparable to pre-pandemic baselines.

KEYWORDS

AANEM, electrodiagnostic testing, EMG, NCS, safety

1 | INTRODUCTION

The coronavirus disease-2019 (COVID-19) pandemic drastically affected health-care utilization in the United States, with widespread cancellation of nonurgent medical procedures during the initial surge, including a majority of electrodiagnostic (EDx) studies. Early in the pandemic, the American Association of Neuromuscular & Electrodiagnostic Medicine (AANEM) Quality and Patient Safety Committee disseminated guidance on triaging EDx referrals and maintaining safety standards on its website and later in print.¹ As the initial surge of the pandemic passed in certain parts of the United States, the same group provided guidelines on the reopening of EDx laboratories, addressing a broad range of topics from patient arrival to equipment cleaning and maintenance.² Other experts advised adapting workflow appropriate to the severity of the pandemic in individual regions,³⁻⁵ whereas some proposed specific EDx techniques to minimize the risk of COVID-19 transmission between clinicians and patients.⁶

In the reopening of our EDx laboratory, we aimed to adopt these guidelines and measure outcomes in terms of clinical volumes, billing, shifts in diagnoses, and rates of suspected and confirmed COVID-19 among patients and laboratory staff. In this article, we detail our experience over the first 6 months of reopening our EDx laboratory, and share the lessons learned.

2 | METHODS

Our EDx laboratory was reopened under the guidance of the AANEM^{1,2} and advice of other experts,³⁻⁵ with subsequent revisiting of important recommendations to optimize safety and minimize risk of COVID-19 transmission. We reviewed the data on all outpatient and inpatient EDx studies from June 1 to December 1, 2020 using a combination of billing queries and electronic health record review. We reviewed our billing patterns during this period and the primary diagnoses seen as divided into mononeuropathy, polyneuropathy, plexopathy, myopathy, motor neuron disease, and other symptom-based categories. We reviewed the rates of suspected and confirmed COVID-19 among patients who had been evaluated at our center and among our staff. Institutional review board approval was not sought as no patient-level data were assessed.

3 | RESULTS

Our EDx laboratory is based at a major academic center. A state of emergency was declared in our state on March 10, 2020, leading us to close our laboratory on March 13. The number of daily new cases of COVID-19 increased and peaked on May 1 at 2106, with subsequent decline.⁷ As it decreased to approximately 600 new cases per day, we reopened our outpatient EDx laboratory on June 1 with our own specific steps, as summarized in Table S1. Our EDx laboratory has six neuromuscular physicians and two EDx technologists. As we adapted new practices continuously, appointments were booked up to 2 weeks in advance instead of 8 weeks before the pandemic.

From June 1 to December 1, 2020, we completed 816 outpatient studies with a no-show rate of approximately 16%, compared with 837 over the same time period in 2019 with a no-show rate of approximately 25%. We completed 21 urgent studies, defined as those for which referred patients needed approval from an EDx laboratory physician to obtain an appointment within 7 days. Nineteen studies were performed for acute or subacute extremity weakness and/or pain with a subset secondary to trauma such as iatrogenic injury from a surgery or work-related injuries. The remaining two were performed for winged scapula and acute lower extremity sensory loss. Our clinical volume increased steadily over our reopening period, as shown in Figure 1. We did not complete any studies on patients with suspected or newly confirmed COVID-19. Patients who had prior COVID-19 were required to have a negative test any time before their outpatient EDx appointment. We canceled seven studies after a patient had arrived at the laboratory—two who reported community exposure without subsequent COVID-19 testing, one who reported a fever on the previous night, one who had recently returned from a high-risk state, one who had COVID-19 positivity without a subsequent negative test, one who had low-grade fever, and one who had brought an infant to the laboratory without another adult who could care for him during the study.

The billing codes for nerve conduction studies are shown in Table 1. The laboratory generated 3586 relative value units (RVUs) over the study period in 2020 compared with 3682 in 2019. The average RVUs per study was 4.39, similar to the 4.40 in 2019. There were no major shifts in the distribution of primary diagnoses (Table 2).

During this period, 12 inpatient EDx studies were requested and 10 were completed for patients who had tested negative for COVID-19. The two requests for patients with COVID-19 were converted to in-

EDX Studies by Week

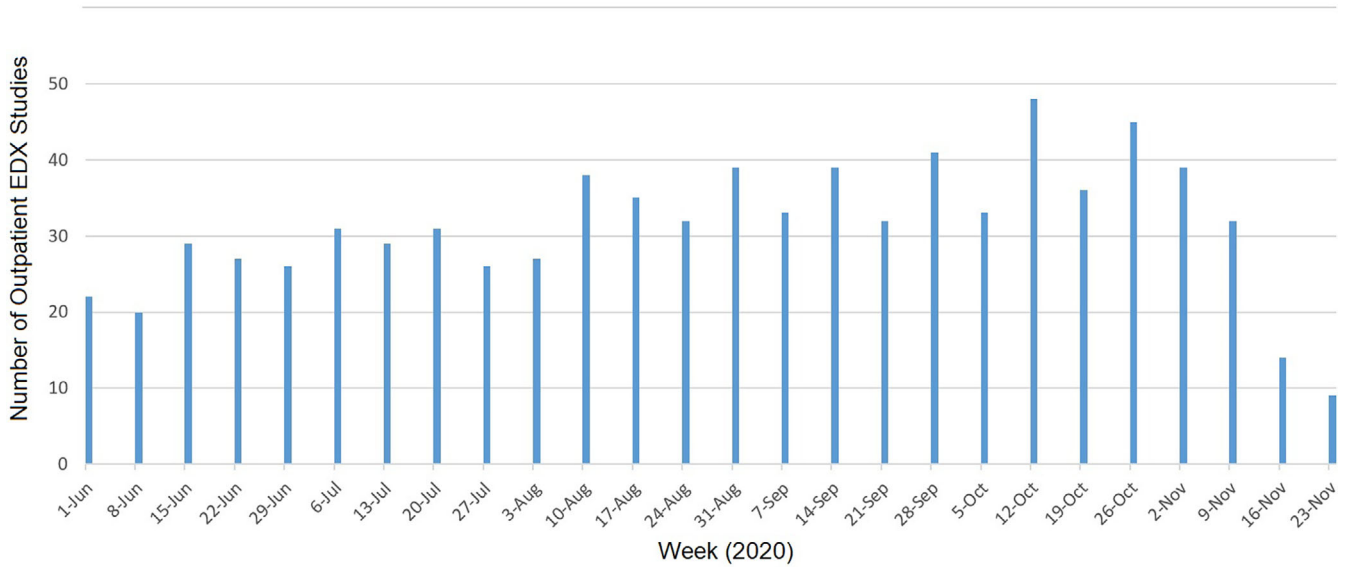


FIGURE 1 Completed weekly outpatient electrodiagnostic studies from June 1 to December 1. Note that the decrease in studies completed in November corresponds to staff vacation times around the Thanksgiving holiday. Abbreviation: EDx, electrodiagnostic [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 1 CPT codes for nerve conduction portion of outpatient EDx studies from June 1 to December 1 in 2019 and 2020

CPT code	2019	2020
95 907	3	2
95 908	4	5
95 909	12	33
95 910	155	116
95 911	242	231
95 912	227	210
95 913	194	219
Total	837	816

Abbreviations: CPT, current procedural terminology; EDx, electrodiagnostic.

TABLE 2 Diagnosis distributions for outpatient EDx studies from June 1 to December 1 in 2019 and 2020

Primary diagnosis or symptom	2019	2020
Mononeuropathy	201	155
Polyneuropathy	45	44
Plexopathy	2	8
Myopathy	4	6
Motor neuron disease	2	1
Neck or back pain	459	503
Extremity pain	43	29
Paresthesias	40	31
Other	41	39
Total	837	816

Abbreviation: EDx, electrodiagnostic.

person neuromuscular consultations, due to sufficient clinical suspicion of Guillain-Barré syndrome secondary to the infection.

No patient who had been evaluated at our EDx laboratory tested positive for COVID-19 within our health system within 10 days, as such an instance would trigger an alert for clinicians. One EDx physician and one EDx technologist were tested for COVID-19 due to concern for associated symptoms, neither with exposure to a patient with suspected or confirmed COVID-19. Both tests returned negative.

4 | DISCUSSION

Our experience suggests that, by following the guidance of the AANEM supplemented by other expert opinion, it is possible to safely

reopen an EDx laboratory. We were able to maintain a clinical volume and billing rates similar to pre-pandemic baselines, which we attribute to two factors. First, our no-show rate greatly decreased, likely due to a shorter interval between the scheduling and procedure dates. Second, although we scheduled fewer studies per half-day session, we proportionately increased the total number of sessions per week, as detailed in Table S1.

We found that the average RVUs per study was similar to that in 2019, without a notable decrease in the number of nerves sampled per study. This reflects that we did not abbreviate our studies as recommended by some experts,³ as we considered that a more comprehensive study may decrease the need for repeating it later in the pandemic. As well, we found no major shifts in primary diagnoses

from 2019 to 2020, which was as expected, as we operated the laboratory to conduct both routine and urgent studies.

The major limitation of our study is that we did not formally track patients who were evaluated at our laboratory to determine whether they were subsequently diagnosed with COVID-19. Although EDx laboratory staff would be notified if patients were diagnosed with COVID-19 in our health network within 10 days, it is possible that patients could have sought care elsewhere. Another limitation is that we are unable to prove a causal relationship between the precautions taken and the outcome of no known COVID-19 transmissions, but we infer that the combination of measures was effective. In terms of the remainder of the data, we based clinical volumes, billing rates, and primary diagnoses on billing queries, with intrinsic errors related to how information is coded, stored, and abstracted.

Based on our 6-month experience, we have three recommendations that may be applicable beyond the operation of EDx laboratories. First, we advocate that clinical leaders should conduct frequent and detailed literature searches for guidance on workflow adaptations relevant to their clinical area. Given great inter-institutional variations, the expectation is not to adopt all suggestions but rather consider and select those that are applicable and to modify as appropriate. In our case, we relied heavily on early guidance from the AANEM and later incorporated the advice of other experts.

Second, all major decisions in adapting workflows should incorporate input from a diverse group of stakeholders, in our case physicians, technologists, administrators, and schedulers. In particular, our technologists took the lead in coordinating room rearrangements, designing preassembled equipment kits, and establishing cleaning protocols (Table S1). We also invited personnel outside of our group, such as our clinical nursing supervisor, to review our protocols from an external perspective.

Finally, we recommend rigorous and continuous internal auditing of workflow. We heeded the AANEM's advice to take a stepwise approach toward reopening, gradually increasing our clinical volumes only after reviewing data from previous weeks, with particular attention to cases in which there were delays, inefficiencies, and, most importantly, safety issues. For example, our initial room rearrangements led to inefficiencies as clinicians were unfamiliar with where equipment was stored, leading to the design of uniform room arrangements. Through this exercise, we have deliberately rebuilt our clinical output over time. We believe the principles of frequent literature appraisal, solicitation of diverse opinions among team members, and continuous auditing of workflow may be applicable to future public health crises as well.

In our reopening experience, we have greatly benefited from the advice of experts and peers in the scientific community. As

such, we invite others to share institutional-level data and recommendations based on their experiences. Through this pandemic, it has become clear that the optimization of patient care and safety requires the best of our collective knowledge and creativity.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

ETHICAL PUBLICATION STATEMENT

We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

DATA AVAILABILITY STATEMENT

Data available on request from the authors

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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