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Neurosurgery in COVID-19 Ground Zero: The Weill Cornell Medicine Experience

Graham M. Winston¹, Andrew L.A. Garton², John K. Chae¹, Eseosa R. Odigie¹, Ryka R. Sehgal¹, Maricruz Rivera², Jacob L. Goldberg², Ibrahim Hussain², Rupa G. Juthani², Michael Virk², Susan C. Pannullo²

The mobilization of subspecialty departments in reaction to the unique demands of the onset of the coronavirus disease 2019 (COVID-19) pandemic in New York City was swift and left little time for reflection and commemoration. The early days of the pandemic brought unprecedented stressors on the medical system that necessitated a restructuring of hospitals, reallocation of health care workers, and a shift in care and education paradigms to meet patient care demands and public health needs. As the number of cases, intensive care unit patients, and deaths skyrocketed in New York City, many struggled with a somewhat paradoxical difficulty in perceiving the human value of what these numbers mean. Easily lost in the statistics are the stories and experiences of the physicians and trainees who were counted on to halt their own clinical practices and adapt their skillsets to tackle the pandemic. In this article, we present 10 brief narratives from the student members of the Neurosurgery Publication Group at Weill Cornell Medical College and members of the Weill Cornell Medicine Neurological Surgery Residency Program and Department of Neurological Surgery faculty. Reflecting on these individual experiences gives us an opportunity to simultaneously contribute to a history of New York City's reaction to COVID-19 and commemorate the individuals who were impacted by or succumbed to this disease.

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic brought unprecedented stressors on the medical system that necessitated a restructuring of hospitals, reallocation of health care workers, and a shift in care and education

paradigms to meet patient care demands. As the number of cases, intensive care unit (ICU) patients, and deaths skyrocketed in New York City in the spring of 2020, many struggled with a somewhat paradoxical difficulty in perceiving the human value of what these numbers mean. Easily lost in the statistics are the stories and experiences of the physicians and trainees who were counted on to halt their own clinical practices and adapt their skillset to tackle the pandemic. Reflecting on these individual experiences gives us the opportunity to simultaneously contribute to a history of New York City's reaction to COVID-19 and commemorate the individuals who succumbed to the disease. In this article we present personal reflections from 10 of us—4 who were medical students at Weill Cornell Medical College during the peak of the 2020 outbreak in New York City, 4 who were in the Weill Cornell Medicine Neurological Surgery Residency Program, and 2 who were attending neurosurgeons in the Weill Cornell Medicine Department of Neurological Surgery. Photographs depicting the stillness of the usually bustling city are presented in [Figure 1A–D](#).

REFLECTIONS

As first-year students, we charged ahead in our training with little real sense of where we were going. In a flash, medicine had transformed its presence in the lives of my classmates and me from something chosen to something inescapable. With the rise of the virus, suddenly medicine had become a very real presence in every conversation and every room.

Driven by the desire to offer a space to process collective grief in the form of writing, my fellow co-directors of *Ascensus: WCM Journal of Humanities* and I decided to collect 6-word reflections on COVID-19 and quarantine experiences from our colleagues. We opened this as a means of catharsis, a small space for our peers to distill their concerns and thoughts into a few words. Some were wry (“when did I last wear pants?” and “I will wash my hair, tomorrow”), others gut-wrenchingly despondent (“we can't come back from this” and “we never got to say goodbye”).

Key words

- COVID-19
- Neurosurgery
- New York City
- Pandemic

Abbreviations and Acronyms

COVID-19: Coronavirus disease 2019

ED: Emergency department

ICU: Intensive care unit

OR: Operating room

PPE: Personal protective equipment

From the ¹Weill Cornell Medical College, New York; and ²Department of Neurological Surgery, Weill Cornell Medicine, New York, New York, USA

To whom correspondence should be addressed: Susan C. Pannullo, M.D.
[E-mail: Scp2002@med.cornell.edu]

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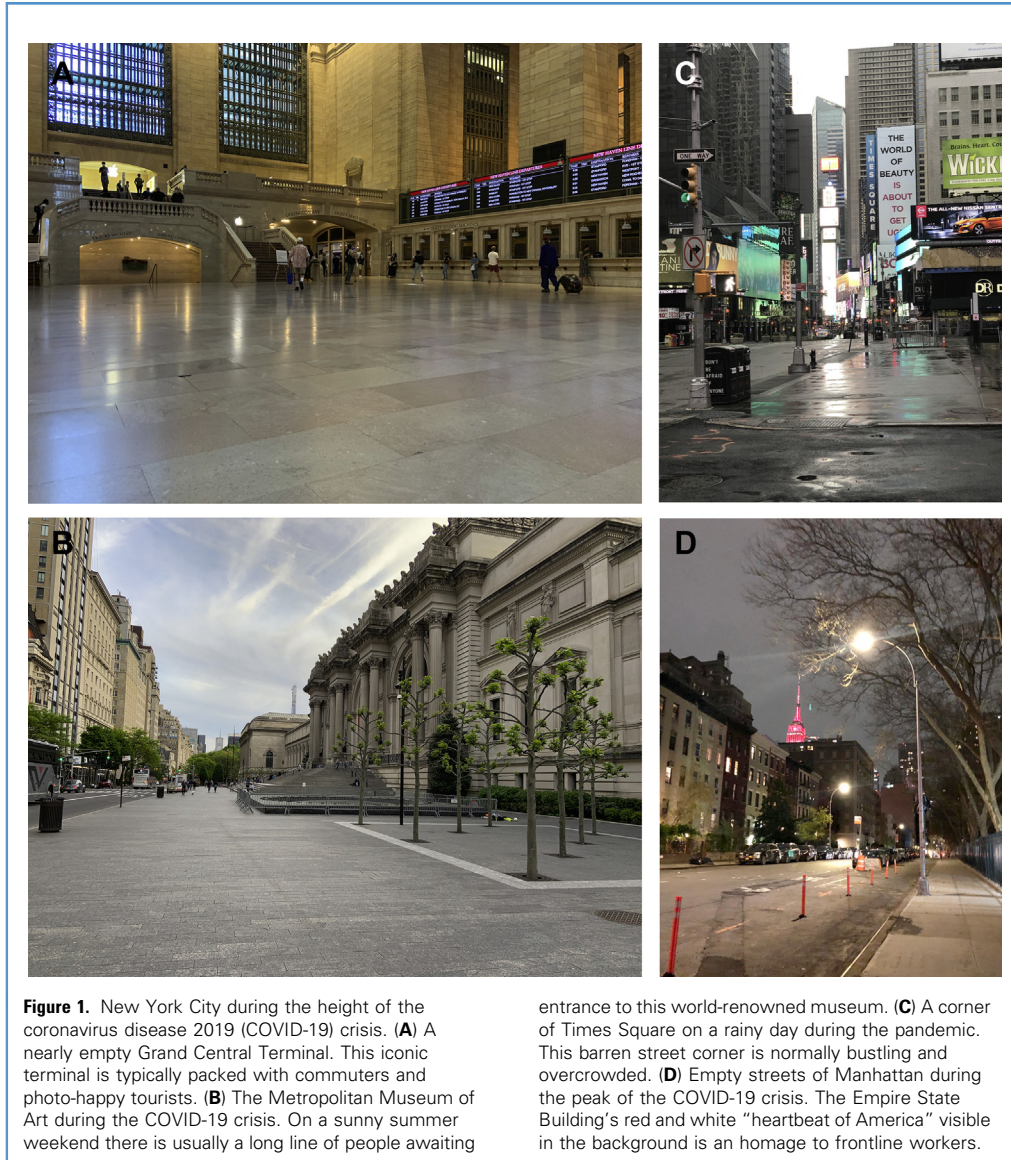


Figure 1. New York City during the height of the coronavirus disease 2019 (COVID-19) crisis. **(A)** A nearly empty Grand Central Terminal. This iconic terminal is typically packed with commuters and photo-happy tourists. **(B)** The Metropolitan Museum of Art during the COVID-19 crisis. On a sunny summer weekend there is usually a long line of people awaiting

entrance to this world-renowned museum. **(C)** A corner of Times Square on a rainy day during the pandemic. This barren street corner is normally bustling and overcrowded. **(D)** Empty streets of Manhattan during the peak of the COVID-19 crisis. The Empire State Building's red and white "heartbeat of America" visible in the background is an homage to frontline workers.

Most striking were those that were hopeful. In spite of the blizzard of fear, soul-baring confessions of “found peace by, and within, myself” and the quiet mantra of “please do not feed the worries” acknowledged that the human spirit can overcome even the most consuming collective trauma. Small notes of gratitude, that the “sunset has different colors every day,” were like life rafts, and sharing them validates the steadfastness and strength of our medical community. These reflections remind us that we are not alone, to “breathe and believe that humanity exists.”

—Ryka Sehgal, first-year medical student

Once again, I picked up the phone and dialed. After a week of calling my patient nearly every day, I hoped that today the coughing would have resolved. As soon as she answered, her

“hello” was followed by a minute-long coughing fit before she could speak again. Fits of coughing and wheezing bookended every sentence she spoke. Her frustration was undeniable.

After reviewing her vitals and conducting a telehealth physical examination, I asked if she had any questions. To my surprise, she started crying—one of her family members was now on a ventilator. This was not the first time I heard a patient fear that once someone was on a ventilator there was little hope for recovery.

In mid-March, medical students were pulled out of clinical rotations, and suddenly the virus had gone from a dystopian nightmare we read about in the news to something literally present in the air around us. The following week, in an effort to preserve personal protective equipment (PPE), medical students were banned from scrubbing in on surgical cases. Those of us interested in surgical subspecialties struggled to achieve adequate

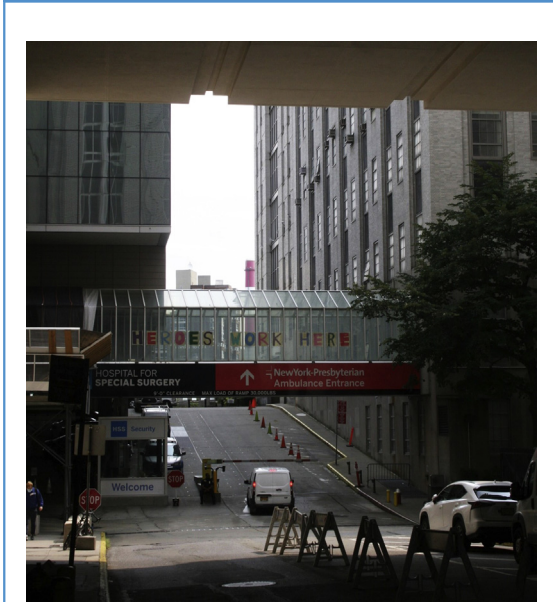


Figure 2. NewYork–Presbyterian/Hospital for Special Surgery bridge with a sign thanking health care workers, on a street normally bustling with hospital bound patients, employees, and visitors. The Heroes sign was created by Child Life Specialist Nora O’Connell and Art Therapist Jackie Tassiello early in the COVID-19 pandemic in an effort to buoy the spirits of first responders.

surgical clerkship training while watching the cases on screens in the operating room (OR).

During the academic pause, I had the opportunity to join a COVID-19 telehealth clinical elective. Students were tasked with following up with COVID-19 patients—conducting physical examinations over the phone, assessing the status of the patients, seeking help from attending physicians if the patients required it, and providing mental health resources if necessary. There were hundreds of patients to call. Dial tone after dial tone, I would brace myself for the inevitable sinking feeling of hearing someone decompensate “in front of me” from afar, as many of these patients had comorbidities that put them at higher risk of developing serious symptoms. Sometimes no one would answer, and we were left to fear that their condition had worsened or that they had succumbed to the illness. We worked diligently to ensure that no patient fell through the cracks and that every patient was accounted for.

—Eseosa Odigie, second-year medical student

While quarantined in my apartment, located just across the street from the hospital, I could not help feeling a sense of frustration and helplessness. Perhaps it was the proximity of the pandemic. Perhaps it was the desire to test the clinical skills I had gained after a full year of clinical rotations. Perhaps it was the memory of the various residents and attending physicians I had worked so closely with until recently. I felt dissonance between my instinct to be active on the front lines and the practical reality of

insufficient hospital resources, the necessity of quarantine and social distancing, and my own limitations.

For my third-year classmates and me, our transition to fourth year became uncertain, and a general sense of anxiety permeated. Despite this uncertainty surrounding our future, however, many of us also felt a sense of duty to help. We channeled this instinct into mobilizing various student-led efforts, such as gathering PPE donations, to help in any way we could. I helped build a Weill Cornell Medicine COVID-19 registry, which ultimately included more than 4000 cases, and it served as a guide to our clinicians.

This chart-abstracting effort involved sifting through documentation—emergency department (ED) notes, admission notes, progress notes, updates, and, in some cases, death notes. Through their writing, I often sensed their collective urgency, desperation, and chaos. Through their writing, I followed the narratives of many ICU patients with prolonged hospital courses, and as my list of faceless names grew longer and longer, I felt the horror of the pandemic. For many, these narratives would end in eventual recovery and discharge. For some, however, their narratives met a premature end in the ICU. All this time, there I was in my apartment across the street, experiencing the immense pain that the pandemic had brought.

—John Chae, third-year medical student

As news of international devastation caused by the COVID-19 outbreak intensified, so too did my preoccupation with the subject. Some combination of fourth-year boredom, an attempt to distract myself from a rapidly approaching match day, and genuine fear for what was to come led me to spend my time reading everything I could find about the epidemic. My research, however, came nowhere close to preparing me mentally for what was to come.

When medical schools throughout New York City began announcing their plans for graduating medical students early, it was an easy decision for me: after spending so much time and energy intellectualizing the crisis, I finally had the opportunity to help.

So, I set off on my drive back to New York from Ohio, where I had been staying with family. Somewhere in Pennsylvania, driving east alone on I-80, I graduated from medical school via e-mail and became a doctor. In such a strange time, it didn’t feel so strange. Nor did it feel particularly out of the ordinary to take the Hippocratic Oath by video call a few hours later. The words “I now turn to my calling with the reward of a long experience in the joy of healing” resonated with me regardless of the medium on which I was reciting them.

In the ensuing weeks, when I worked behind the scenes arranging transfers to a COVID-19 field hospital, I couldn’t help but feel that I was making a difference in the lives of COVID-19 patients who could not find a hospital bed and essential frontline workers who were overextended. Like many medical students, I often found myself feeling unhelpful, superfluous, and, at times, like a burden to the team. Finally, after years of wishing I could do more, I finally felt like I was making a valuable contribution at a time when this city and this country needed it most.

—Graham Winston, fourth-year medical student

The first day of residency, I walked into a room where every single person in that room knew exponentially more about the job I was about to do than I did. The first day of working in a COVID-19 ICU, no one knew what to do. Data collection was immediately initiated, and it felt as if a new protocol was announced every day. Early intubation, early paralysis and prone positioning, ubiquitous therapeutic anticoagulation, daily cytokine studies, incessantly frequent coagulation profiles, the specifics and timing of which would change regularly as more in-house data would be analyzed. Pointing us in one direction then the next, the compass of COVID-19 management spun in a circle, never facing true North, though all the while improving in its accuracy.

I spent 5 weeks of days and nights with my co-residents chasing North, with nearly every patient intubated, sedated, paralyzed, and perpetually decompensating. Nurses were tasked with managing twice as many patients as usual, with each case twice as complex, and so they taught us residents how to change drips, adjust ventilators manually, even chart numbers. If a patient wasn't on dialysis, they were placed prone; if they weren't paralyzed, it's because they weren't "waking up," in which case we would fear the worst—that they had sustained an intracranial hemorrhage. Patients straddled a coagulation chasm, where on the one side they would be suffering from COVID-19-associated microthrombi and on the other they'd be susceptible to bleeding as a result of our treatment. Central lines oozed while peripheral arterial lines thrombosed, and thumbs threatened ischemia. A scoring system on the door of each patient's room quantified the extent of systemic organ involvement: from the hallway, we could watch as day-by-day, organs went offline, like a city-wide blackout.

Patient trajectories were unpredictable, and we were left with the almost impossible task of prognosticating outcomes based on ever-evolving data. Afternoon phone calls were the most difficult part of the day. Distilling a patient's course—not to mention trying to sort out goals of care or end-of-life wishes—into something digestible and comprehensible for family without sharing the same physical space was a challenge. It was horrifying to bear witness to the isolation of the sick and dying from their families.

I've laid out a bleak landscape. And yet, patients did recover. The initial tidal wave of crashing patients broke, giving way to improvement in many cases. Maybe it was our steady endeavors to improve management, maybe it was their innate pathophysiology, or maybe it was some combination of both. Regardless, it was surreal to experience—and it was a privilege: the sense of pride at witnessing the mobilization of the entire health care force from surgical directors to respiratory therapists and nurses to the custodial staff. The enthusiasm and rigor that all of my co-residents brought to every day was inspiring, and I will never forget the time I spent in that ICU.

—Andrew Garton, first-year resident

From one day to the next, our surroundings were transformed. I was redeployed in our postanesthesia care unit, which had gone from an open space with curtains separating patients to a

suffocating unit with hastily constructed walls that served as a barrier between the patients and us. Instead of doors, we entered patient areas through tarps opened by zippers. The unit now resembled a pop-up hospital in a war-torn country.

Every patient was critically ill. Every shift started with the feeling of impending doom. It was as if expecting the worst made the worst more tolerable. Anesthesia machines, designed to function only for the duration of a surgical procedure were used around the clock. Single-use N95 masks were used for 1 week, sometimes 2 weeks, at a time. For the sake of our patients, we convinced ourselves our ragged masks were still providing some protection against this terrifying illness. Like our equipment, we pushed ourselves to the limit.

Of the countless patients we treated, one in particular, a 60-something Spanish-speaking man, will forever stay with me. As visitors were not allowed in the hospital, I called the patient's family daily to allow them to see their husband and father. After weeks on a ventilator, his respiratory status was finally favorable enough to consider extubation. While he initially improved, he quickly began to desaturate one night. By the time I got to the patient's bedside, his oxygen saturation was in the 60%–70% range. As his sedative medication had been withheld, he was well aware of everything that was happening. I switched the ventilator to manual mode to begin bagging him but he managed to grab my hand so tightly that I couldn't pull away. His oxygen saturation continued to drop, and I could see the terror in his face. It was just him and me. In that moment, I had to put aside his fears and pull my hand out as hard as I could in order to save his life. The ability to compartmentalize all emotion during a time that required intense focus still amazes me. Unfortunately, he never passed his subsequent extubation trials and, after a tracheostomy placement complication, ended up suffering a devastating hypoxic brain injury. He will never be himself. He will never have meaningful interaction with his family again.

Everyone touched by this illness is forever transformed—the families of our patients and even our own. I had to keep my own two sons far away from me for months for their own safety. Amidst the sacrifices, we found ways to cope: through simple pleasures like seeing my sons on FaceTime, getting a text from my program director just to check in, or being stopped by a stranger on the street just to be thanked. During such an incredibly isolating time, it was comforting to know there were so many people holding us up.

—Maricruz Rivera, second-year resident

It was the end of March when I was pulled from the OR to go to the COVID-19 ICU. While some of the aspects of care of the intubated COVID-19 patients, including management of sedation or paralytics and titrating medications, come as second nature to neurosurgery residents, there was much that we had to learn on the job. Tasks that were at first foreign to me, like managing the different ventilator modes to achieve adequate ventilation as measured by blood gases, were rapidly forced into my repertoire of skills. For most junior residents, this wasn't the first or last time we would be expected to learn on the fly in uncomfortable, novel scenarios.

The vascular effects of COVID-19 presented neurosurgery residents with an opportunity to be of particular assistance on the makeshift, repurposed units. Some patients on our units would experience profound coagulopathy with a tendency for ischemic strokes and/or intracranial hemorrhages. Detecting neurological deficits in patients who are deeply sedated and/or paralyzed to achieve ventilator synchrony is difficult and requires assessment by someone experienced and thorough, and I was happy to help my colleagues reassigned from other services learn how to conduct such a neurological examination. Collaboration, collegiality, and resourcefulness of the reassigned ICU staff were required for the success of these makeshift units. Being on service with physicians from other residency training programs provided us with the opportunity to teach and learn from colleagues from obstetrics and gynecology, urology, plastic surgery, anesthesiology, and otolaryngology. As a result of our collaboration, I'm sure our services will work together closely in the future.

—Jacob Goldberg, third-year resident

In retrospect, what stands out is how fast it all happened. One day I was a chief resident in neurological surgery, just weeks away from completing my training. The next I was being supervised by an anesthesiology resident who was several years behind me but had a lot to teach me about critical care medicine and ventilator management. I found myself in one of the most surreal, life-altering situations imaginable, with patients dying every day despite my best efforts as a doctor. The orderly world of medicine had been turned upside down.

The hospital was nearly unrecognizable. Instead of the usual arrangement of ORs, ICUs, and step-down units, it became one enormous COVID-19 unit. I was thankful that engineers had been working on this transformation for weeks. Patients without COVID-19 were relocated around the city to the Hospital for Special Surgery, the USNS *Comfort* (a U.S. Navy hospital ship), and the Jacob K. Javits Convention Center to make way for the coming surge; elective surgeries were canceled so we could turn ORs into ICUs (and preserve precious PPE); and doctors, nurses, and advanced practice providers were redeployed to the frontlines.

I was assigned to a 28-bed unit filled with COVID-19 patients. Sedated to the point of paralysis, intubated, and fed steady infusions of medication to maintain blood pressure, the patients hovered between life and death. Many of them—far, far too many—ended up on the wrong side of that divide. These were not the same life-and-death situations I'd learned to cope with in my 7 years of neurosurgical training, such as those involving patients with traumatic brain injuries or malignant brain tumors. There were no solemn conversations in which I could look into someone's eyes to convey both gravity and empathy. There were no family meetings to ensure that everyone understood what was going on with their loved one. I knew that the patients who lost their battle would die in solitude, with their families denied the chance to say goodbye that would normally help ease the grief. Nothing about this was normal.

The sense of solitude in a city of 8 million people was overwhelming—not only were patients alone in their rooms, but people all over the city were confined to their homes. Those of us trying to care for the sick were also alone, afraid to go home and risk infecting our own families. I was grateful to have the option of staying in a nearby hotel to protect my wife and our two small children, but I didn't see them for many weeks, and the solitude weighed heavily on me, too.

I tried to focus on the small victories and how gratifying it was to be urgently needed every minute of every shift. I essentially chose neurosurgery for this very reason; this experience brought me back to the basics of patient care and saving lives wherever I could. Fate put me in one of the largest hospitals in the largest city in the United States, at the epicenter of this historic pandemic, and gave me a unique role to play. I couldn't be more grateful to have had that opportunity and to have been entrenched with the co-residents, physician assistants, nurse practitioners, nurses, and attending physicians who battled with me.

—Ibrahim Hussain, seventh-year resident

Neurosurgeons are uniquely equipped to make life-and-death decisions on a daily basis, often with minimal time and limited information. The COVID-19 crisis tested the limits of our resilience, and we responded with fervor and determination, reassigned across the hospital system to care for patients with this devastating disease. During this time, many of us were forced to balance the best interests of the patient, our staff, and the public simultaneously, which brought to light opportunities for long-term change in the approach to neurosurgical patients and health care as a whole.

Once a neurosurgeon, now a hybrid between a medical hospitalist and an intensivist, I found myself once again hitting the books, brushing up on areas of medical care that were less familiar to me. During the nearly daily cardiac arrests that happened on the floor, I felt at ease, horrified by the frequency but calm and collected in this high-pressure environment. Deciding about a second-agent antihypertensive, on the other hand, induced more anxiety than the code blues and reinforced the decision I made to become a surgeon in the first place.

As surgeons, we typically make decisions in the best interest of our patients, and while this often extends to consideration of the overall needs and goals of their families, we are rarely forced to think about the impacts on society as a whole. Consideration of societal impacts of our decisions would perhaps lead us to question some of the life-saving, but not life-improving, surgeries we offer. The resource-limited COVID-19 environment forced me and others to reconsider much of what we offer patients with devastating neurological conditions. The decision to operate on COVID-19-positive patients weighed against risks of exposures and resource utilization was a part of our everyday calculus as we tried to fulfill our Hippocratic Oath and serve our communities.

Perhaps the most challenging aspect of this decision-making process, however, was that visitor restrictions limited the discussions with loved ones that we rely so heavily on. Discussion of urgent surgical needs or relaying devastating news without the benefit of a face-to-face conversation limits our ability to build

rapport, provide support, or, perhaps most importantly, offer hope to families that need it.

—Rupa Juthani, attending neurosurgeon

On March 27, 2020, I reported to the NewYork–Presbyterian/Weill Cornell Medical Center ED conference room for orientation. The last time I was in this room, I was giving a talk to the ED faculty about advances in spine surgery. Today, I was attending a crash course designed by ED faculty to orient non-ED staff on COVID-19 ED management.

The night prior, I experienced an unusual chill on my walk home from the hospital. At home, my temperature measured 99.8°F. A recheck the next morning, however, showed a normal temperature, and I reported to the ED for day 1 of redeployment, wearing a complete set of PPE—hat, goggles, N95 mask with surgical mask over it, scrubs with disposable overcoat, gloves, and booties. I recounted my febrile episode to the ED staff and the consensus opinion was to go home to see how the next few days went. My request for a COVID-19 swab test was denied by both the ED and Workforce Health and Safety—given the shortage, tests were reserved for patients requiring hospital admission.

That evening, I developed a mild headache, painful extraocular movement, chills, cold sweats, and a fever to 101°F. By the next morning, however, the fever was gone and I naively felt triumphant. In actuality, my symptoms would recur in a cyclical fashion for the next 5 days, one night accompanied by hallucinations. My senses of taste and smell receded until they were totally absent. On the fifth and final day of my illness, my wife developed symptoms, and I assumed care of our three girls, ages 2, 4, and 5, and tried to provide her with the same attentive care she gave me during the previous week. Quarantine within our Manhattan apartment was nonexistent; there was total exposure. We were grateful that the girls never developed symptoms.

I returned to that same ED conference room during the first week of April. For the next 6 weeks, I worked alongside ED physicians, urologists, general surgeons, neurologists, and ophthalmologists during the peak of the pandemic in New York City, at the apex of the admissions curve. While I thought that I would be most useful helping reduce the burden of ED physicians by taking care of patients with neurosurgical pathology who walked through the door, in reality, there were very few non-COVID-19

visits. So, we treated and learned about COVID-19 and the patients who had contracted it together. The ED experience was a total departure from my daily routine of ORs and outpatient clinics. So, too, were the dark, empty, quiet, and frankly eerie streets that awaited us when we walked home. And while this unprecedented event forced us to confront the limits of what our systems could manage, it also reminded us of the power we wield when we are united.

—Michael Virk, attending neurosurgeon

CONCLUSIONS

The medical community has not seen a pandemic like COVID-19 in the United States within most practitioners' lifetimes, and by the time this collection appears in print, every corner of the country will have been deeply, irreversibly affected. The virus laid siege to New York City from March through June, and like every other hospital in the tri-state area, ours was asked to marshal resources and mobilize quickly. Amidst the chaos and fear, members of our community across all ages and levels of training found inspiration and motivation in our patients and colleagues and within ourselves (Figure 2). We hope that these reflections serve to memorialize the response of our medical students, residents, and faculty to the COVID-19 pandemic and the patients for whom we provided both neurosurgical and nonneurosurgical care.

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