

CURRENTS

The Official News Magazine of the Neurocritical Care Society • September 2020

REFLECTING ON COVID-19

Anticipating
the Future



CURRENTS

News magazine of the
Neurocritical Care Society

September 2020

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Dear Colleagues,

I would like to welcome you to the September issue of *Currents*, the official news magazine of the Neurocritical Care Society (NCS). On behalf of NCS, I would like to welcome all of you to the virtual 18th Annual Meeting. This meeting is unique as it will always be remembered as the first virtual meeting of our Society. The meeting theme this year is **"From Research to Recovery,"** and the event aims to deliver virtual workshops, educational and poster sessions, and bring our NCS members together to network. We invited Mary Kay Bader and Wade Smith to cover some information on what to

expect at our flagship annual event on page 4.

As COVID-19 continues to impact all of our lives, I'd like to express my genuine appreciation to our Editorial Board members who have been operating hard over the last year to cover informative and exciting news articles and features that are sure to educate you. This content has expanded this magazine and grown our national and international readership. Throughout this year, we have proudly covered pandemic-related articles and shared how members of the neurocritical care community have fought on the frontlines, sometimes traveling to the pandemic's hardest-hit areas. In this issue, you'll read one of those stories on page 6. We've also included an important call to action for our readers to participate in COVID-19 research opportunities.

“Throughout this year, we have proudly covered pandemic-related articles and shared how members of the neurocritical care community have fought on the frontlines, sometimes traveling to the pandemic's hardest-hit areas.”

We're proud to feature a unique look at the international response to the pandemic in Ecuador on page 14 and Qatar on page 16. We've included several COVID-19 perspectives: One about how the virus has highlighted the importance of proper mechanical ventilation strategy on page 24, and you'll read personal reflections from a deployed NYC COVID-ICU nurse practitioner on page 26.

Currents keeps you connected not only to the neurocritical care field but also to the important happenings within NCS. We're happy to share reports from several areas of our organization, including Women in Neurocritical Care, Nursing, Fellowship Directors and Research Operations.

I would like to congratulate the whole *Currents* team and everyone who supports the *Currents* spirit and advances its exciting mission for these exciting achievements and commend them on their commitment and extraordinary dedication. I hope you enjoy this issue. As always, the *Currents* team is interested in sharing your neurocritical care perspectives. Please **email me** for details on how to submit content. Thank you for reading and stay safe and well.

I am so excited to celebrate the virtual 18th Annual Meeting and hope to see you there!

Sincerely,
Saef Izzy, MD

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What to Expect from the 18th Annual Meeting

By Mary Kay Bader, RN, MSN, CCNS, FNCS, FAHA; and Wade Smith, MD, PhD, FNCS

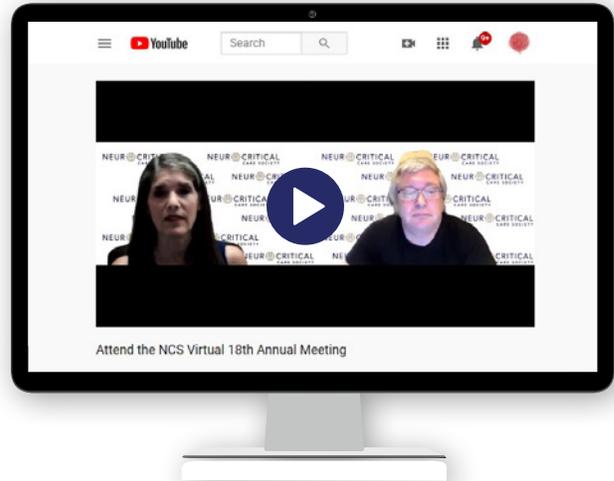


Mary Kay Bader, RN, MSN, CCNS, FNCS, FAHA



Wade Smith, MD, PhD, FNCS

As we continue to manage through these tumultuous times — the pandemic and ongoing protests on social justice and equality — we look forward to this year's virtual Annual Meeting on Sept. 22–25.



Virtual Meeting Defined

The four-day long virtual NCS Annual Meeting will deliver workshops, educational sessions, poster sessions, a virtual exhibit hall and networking events that you've come to expect from NCS — all in an online setting. Attendees also will have the opportunity to earn continuing education credits.

Education Content

Each year, the Annual Meeting Committee makes a concerted effort to offer educational content that appeals to our multidisciplinary members to ensure there are sessions for everyone.

Visit the Virtual Exhibit Hall

In the online exhibit hall, you will have the opportunity to chat with exhibitors, ask questions, send messages and set up one-on-one visits. Learn about new products that are useful in the ICU and programs and events that enhance your knowledge.

Poster Sessions

Take the virtual poster walk and listen to presentations from your colleagues, residents and fellows. Meet the presenters as they share their project scope, data and outcomes. The poster sessions will equip you with knowledge never before reported in the neuroscience arena.

As the meeting draws near, you will receive tools and tips on how to navigate through the virtual meeting platform and strategies for staying engaged all day in an online setting.

We look forward to continuing our mission of engaging and educating all neurocritical care practitioners at our 18th Annual Meeting! ●



Fellowship Directors' Section Update

By Angela Hays Shapshak, MD; and Atul Kalanuria, MD



Angela Hays
Shapshak, MD



Atul Kalanuria,
MD

The past several months have been eventful for those of us involved in neurocritical care education. As I'm sure you are aware, the first ABMS Neurocritical Care examination is scheduled to take place in October 2021;

applications will become available in December of this year. As announced at the recent meeting of the AAN CCEN Section, the exam is now being co-sponsored by the American Boards of Internal Medicine and Surgery, in addition to Neurology, Anesthesiology, Emergency Medicine and Neurosurgery. A grandfathering period of six years is anticipated. Criteria for exam eligibility can be found on the ABPN website (<https://www.abpn.com/become-certified/taking-a-subspecialty-exam/neurocritical-care/>).

In conjunction with the development of the ABMS certification pathway, the ACGME has convened a Neurocritical Care Working Group, which is in the process of developing program requirements. The ACGME has indicated that the program requirements will be released for public comment prior to finalization; it is anticipated that they will be finalized by July 2021. ACGME personnel indicate that programs may begin submitting applications for accreditation as soon as the program requirements are finalized.

Although the ABMS/ACGME certification pathway should be available within the next academic year, there are no plans to phase out UCNS certification or program accreditation. In fact, 136 applicants received UCNS neurocritical care certification in 2019, and the next exam is scheduled for November 2021. This examination will be open to AOA-certified physicians as well. The UCNS has also implemented their continuous certification pathway for all diplomates, similar to the Maintenance of Certification programs offered by many ABMS boards. Details can be found at https://www.ucns.org/Online/Certification/Neurocritical_Cert.aspx.

From an accreditation standpoint, the UCNS neurocritical care milestones have completed a one-year pilot phase and will be required for all accredited programs in 2021.

Although the ACGME/ABMS recognition of neurocritical care as a distinct subspecialty represents a notable milestone for the neurocritical care community, the coexistence of multiple credentialing pathways poses challenges. In fact, the American Board of Neurological Surgeons has indicated that they will continue to accredit fellowships through the CAST program; graduates of CAST fellowships will be eligible for ABNS recognition through the Recognition of Focused Practice Program. Under these circumstances, it is possible that there

“This has been a challenging year for trainees and programs with many being redeployed to cover patients affected by COVID-19.”

may soon be three different sets of program requirements, milestones and core curricula for neurocritical care trainees. Some NCS members have already taken note of a discrepancy between the ABPN and UCNS requirements for neurosurgical candidates interested in neurocritical care training. In the interest of resolving this disconnect, Drs. David Hwang and Paul Vespa from the Critical Care and Emergency Neurology Section of the AAN have worked with NCS leadership to draft a proposal to bring UCNS requirements into accordance with those of the ABPN. If approved, this proposal would allow neurosurgical trainees to complete in-folded fellowships after their third year of training and divide the 12-month training program into four-month blocks. This proposal has been submitted to UCNS and is awaiting board approval.

Considering the changing landscape of neurocritical care training and credentialing, NCS leadership have recently approved the creation of a new committee, the Neurocritical Care Training Committee (NCTC). It is anticipated that this new group will serve as a liaison to credentialing and certifying organizations. In keeping with the multidisciplinary nature of NCS, this committee will advocate for the needs of neurocritical care educators and trainees from various backgrounds and at every level. It is anticipated that the NCTC will work closely with existing NCS committees and sections, including the Educational Products Committee, the Fellowship Directors' and Trainees' Sections, and the Annual Meeting Committee to further the NCS goal of standardizing neurocritical care training and fostering leadership in education. We hope to be able to share more on this new initiative in the near future.

The Fellowship Directors and Trainees sections have jointly developed a survey that will aim to reduce the discrepancy between programmatic information that is available through the UCNS and the NCS websites. This annual survey focuses on gathering information that is specifically designed to help applicants who are in the process of choosing neurocritical care as their career. Given the wide variation between individual fellowship training programs, this survey will ask programs to enter details ranging from fellowship size, number and accreditation to mentorship, research and curriculum information. Currently, this survey is pending board approval.

To conclude, this has been a challenging year for trainees and programs with many being redeployed to cover patients affected by COVID-19. We extend our thanks to everyone who has played a role in this current pandemic. ●

Volunteering in a COVID-19 ICU: My NYC Experience

By Pravin George, DO, assistant professor of Neurology, Cleveland Clinic Lerner School of Medicine; staff, Neurointensive Care, Cerebrovascular Center, Cleveland Clinic



Pravin George, DO

More than three months ago, New York City experienced the largest reported metropolitan surge of COVID-19 patients in the entire country, possibly in the entire world. In the blink of an eye, every NYC hospital census took an unprecedented upswing, and ICU teams were all swamped with a single, common, unknown adversary. At several hospitals, no longer was there a division between ICU specialty; every ICU became a COVID ICU. Horror stories of inadequate staffing ratios, personal protective equipment and medication shortages blazed the news media, and every nurse, physician and allied healthcare provider became a “hero” overnight.

Unlike many communities and major cities throughout the country, Northeastern Ohio was not as badly affected during the mid-March surge. Maybe it was the effect of an early shutdown and stay-at-home order, or perhaps it was simply the geographic profile of the area, but the cities and counties were relatively spared. As stroke, intracerebral hemorrhage and subarachnoid hemorrhage numbers plummeted, and the number of COVID admissions remained for the most part very contained, I remember at one point having a census of about four to seven primary neuro ICU patients. The “surge” for us in Ohio seemed to be largely averted.

“At several hospitals, no longer was there a division between ICU specialty; every ICU became a COVID ICU.”

That’s when a memo was released from my institution, Cleveland Clinic, asking for volunteers to assist with the healthcare workers at the frontlines in NYC and Detroit. Should I leave the comforts of my ICU off weeks and leave my wife, three daughters and three-month-old son? Would there be enough PPE? What happens if I get sick? So many thoughts and questions ran through my head in the following days, but coming off the sidelines was something I felt I had to do.

Although much of the NYC experience is a blur in my memories, I vividly remember the first step onto United flight 3011, a flight serviced by a completely volunteer staff. The pilot mentioned that his daughter was a nurse and that this mission to NYC was



Dr. George and his colleagues traveled from Northeastern Ohio to treat COVID-19 patients in New York City.

something very personally important to him. I also remember landing at Newark Airport to signs from the grounds crew welcoming us and a transport taking us to the hospitals in the center of Queens, Brooklyn and Manhattan. As we stepped into the COVID epicenter, we were just a group of 25 people. We didn’t bring much, but what likely helped more than anything else was some sense of hope that they weren’t alone in this fight.

As intensivists and intensive care nurses, we weren’t naive to sickness and death, but the atmosphere was different. Anyone reading this who has worked on the front lines of this disease would tell you the same. Each person had their own way of processing the experience. For me, NYC was my native community, it was the place I grew up and the place where my parents lived. There was some sense of home being only blocks away from the street that my entire family immigrated to and seeing our old house from the hospital windows while working at the same place where my grandfather went when he suffered a stroke many years ago.

Our time in the hospital was extremely busy. The patients were suffering from complex respiratory and coagulopathic issues. In my first hours on the unit, I remember being more concerned about how carefully I was donning and doffing my PPE and about how anxious I was with interacting or coming into contact with any of our patients. However, by the end of my shift on the first day, I learned how to remain cautious but comfortable while working and examining the patients. So comfortable I began aiding our proning team. The residents I worked with were outstanding, and the skills and medicine that they were learning were incredible. These were experiences they will carry with them for their entire lives. Data on what was beneficial for the disease was sparse, and together with the team of intensivists, we were coming up with therapies in real-time.

“Every aspect of the experience had its pluses and minuses, but I had little, if any, regrets in the decisions I made.”

Between shifts, we would exchange ideas in the recharge areas of the hospital and talk about what similarities and differences we were noticing. Working together as a team we were able to help bring the ICU census down to numbers that were more manageable, and eventually able to close some of the makeshift ICU floors.



Dr. George donning full personal protective gear.

I couldn't help but stop and think back; silently reflecting to thank all of my teachers, mentors, nurses, respiratory therapists and other colleagues for all the clinical pearls given to me throughout training. My closest neuro ICU colleagues and I formed a texting group to share some of the latest COVID-19 research and information with each other. We were rapidly coming to the realization that COVID-19 was not simply a severe respiratory disease but more of a multi-systemic and complex interplay between a virus and its host, with a multitude of neurological implications emerging.

I left NYC a few weeks later much more knowledgeable about the disease but with mixed emotions. In the empty airport, I had my first chance to reflect on the entire experience alone for the first time. Most prior evenings, we decompressed together as a group. I remember feeling an element of survivor's guilt and wondering if I could have done more. Every aspect of the experience had its pluses and minuses, but I had little, if any, regrets in the decisions I made.

I am humbled and honored to have been able to work with everyone in New York City. In the days ahead and especially for those facing the "second surge," please stay safe and know that our ICU community supports you. ●



Medical professionals on the plane on their way to serve in New York City.

Past, Present and Future

By Gretchen Brophy, FNCS, PharmD; Diana Greene-Chandos, MD; Marin Darsie, MD; Holly Hinson, MD; Elissa Fory, MD; Nerissa Ko, FNCS; Deepa Malaiyandi, MD; Christa O'Hana S. Nobleza, MD; and Wendy Wright-Siegler, JM, FNCS, MD

Women in Neurocritical Care (WINCC) has evolved over the years to be one of the most active sections of the Neurocritical Care Society (NCS). Here, we'll share the evolution of WINCC and give NCS members a glimpse of what's to come.

In the late fall of 2002, an all-female group of fellows (Chere Chase-Gregory, Anise Ardel, Connie Chen and Wendy Wright-Siegler) from Johns Hopkins started using the acronym WINCC, which stood for "Women in Neurocritical Care." They started meeting once a week for dinner. These meetings became their way to decompress, "check-in" with each other especially if they encountered difficult cases or interactions and give support to each other.

Several years later, Wendy Wright-Siegler and Gretchen Brophy discussed creating a committee focused on *mentoring and supporting women NCS members*, and the name "WINCC" resurfaced. Wendy's idea at that time was to take the "basic elements that I benefited from via fellowship, comradery (mentoring via support, networking, idea sharing and education) and tapping into the available talent by drawing a wider circle."

An early goal was for WINCC to avoid being only for women "but rather was meant for anyone interested in the advancement of women in the field, and in any issues regarding equity and diversity." WINCC evolved into a formal section. In 2017, WINCC sent its first invitations into the wider committee membership under Nerissa Ko and Susana Bowling as the first WINCC Chair and Co-Chair.

In 2018, under the leadership of Diana Greene-Chandos, WINCC held its first open election for the Co-Chair position,, and Deepa Malaiyandi was elected Co-Chair. The decision was made to survey our members on their priorities. Our subgroups were formed around these priorities, which included Families, Mentorship, Social Media/Communications, MINCCs for WINCCs and Research.

The Families group, led by Elissa Fory, envisioned increasing young faculty engagement and participation in the Society and attendance at the Annual Meeting. NCS had the first on-site, drop-off child-care in Vancouver in 2019 called the NCS Kids Space. The group also arranged the first Families Welcome Dinner, which was a wonderful way to connect their NCS family with their own.

The Social Media and Communications group, led by Kimberly Levasseur-Franklin, aimed to harness the power of social media to promote our initiatives. Early this year, we were approved for "#WINCC" on Twitter, and now Marin Darsie and Hana Nobleza are taking it to another level with a dedicated webpage to support diversity, equity and inclusion (DEI) initiatives, highlight the accomplishments of its members and entice an increasingly diverse next-generation to consider a career in neurocritical care.

The Mentorship group, under the leadership of Hana Nobleza, formed a collaboration with the Trainee Section to start a WINCC-specific mentorship program, which led to eight WINCC mentorship pairs in 2019. The WINCC speakers list was also created and has been used to diversify speakers, panelists and moderators.

One of the first Annual Meeting activities that WINCC held was the luncheon learning and networking session. WINCC has established several more programs since, including the Mentorship Mingle we co-host with the Trainee Committee, the annual Kids Space

"NCS is aware of systemic impediments to equity in healthcare, particularly for women and people from under-represented backgrounds."

child care, the Family Welcome Dinner, the WINCC Annual Meeting keynote speaker and the wine and cheese mingle that follows. This year, we are honored that we will be coming full circle as Dr. Chere Chase-Gregory will be giving the 2020 WINCC keynote address.

Before looking forward, it is important to take a moment to recognize the many silent victories that the successful women of our society have won that helped shape workplaces and career opportunities for those of us who have followed in their immeasurable footsteps. To see that there are now closer to equal numbers of men and women neurointensivists in the early career group is truly inspiring and a testament to the sheer will and dedication of these trailblazers and the colleagues and mentors who believed in them, to whom we will always be grateful.

WINCC is excited for the future. We will continue all of our current efforts but also add a Career Enhancement program to provide guidance, Curriculum Vitae reviews and letters of recommendation for promotion or other career-enhancing positions (FNCS, FCCM, etc.). WINCC will continue to advocate for broader diversity, equity and inclusion goals as our natural next step.

NCS is aware of systemic impediments to equity in healthcare, particularly for women and people from under-represented backgrounds. We all want NCS to continue leading by example when it comes to inclusivity. NCS is an organization that prioritizes meeting the needs of its members and the communities we serve. We know the best way to make strides toward this goal is by using our diversity as our strength and bring us together to shape a future for our field that we are all proud of. ●

Stories of Hope: Myra

By Stefanie P. Cappucci, MD, neurology resident, Beth Israel Deaconess Medical Center; and Corey R. Fehnel, MD, MPH, assistant professor of Neurology, Beth Israel Deaconess Medical Center, Harvard Medical School; Section Editor: Michael Reznik, MD, assistant professor of Neurology & Neurosurgery, Brown University/Alpert Medical School



Stefanie P.
Cappucci, MD



Corey R. Fehnel,
MD, MPH



Michael Reznik,
MD

Myra, a 27-year-old nurse practitioner, is one of the many healthcare workers now deemed essential during the COVID-19 pandemic. She also holds a designation that few her age have —she’s a survivor from a severe stroke that almost took her life.

A Christmas Nightmare

It was December 24, 2018, the night of her annual family Christmas Eve party, and Myra was slowly recovering from a week-long sore throat. This year, the holidays promised to be special — Myra had just recently started her first job as a newly-minted nurse practitioner, she had a new apartment, and she was recently engaged. She was looking forward to celebrating all of these big events in her life with family. But a severe, unrelenting headache caused her to leave the party early. This was a headache that she would later call the worst headache of her life, and one that stubbornly lingered despite all kinds of migraine cocktails and opiate pain medications.

Despite some protestation on her part, her family brought her to a local hospital, where some relief set in after the emergency room physician expressed equal concern at the severity of her headache, which had only gotten worse since it began. While an initial CT scan of her head was normal, a painful lumbar puncture suggested that she had elevated intracranial pressure, and a plan to transfer her to Boston to receive more specialized care was set in motion. These would be her last clear memories for over a week, as she was quickly taken to Beth Israel Deaconess Medical Center in Boston.

“No matter how hard I rack my brain for memories after that ambulance ride, they just do not exist anymore,” she recalls. “The only thing I remember is darkness and terror.”

Myra was found to have a cerebral venous sinus thrombosis, or a clot in one of the veins around her brain. Her clot happened to extend from her right transverse sinus into the internal jugular vein — the last stop for blood to make its way out



Myra: A 27-year-old nurse practitioner and stroke survivor.

of the right side of her brain and a particularly bad place to have an obstruction. While this large clot was the cause of her severe headaches, her initial CT scan showed that she had been spared from suffering a stroke or hemorrhage. However, the clot would likely keep getting bigger and more dangerous without treatment, so she was started on a continuous infusion of heparin, a strong blood-thinning medication.

A Dreaded Complication

Only hours later, after settling in the neurology step down unit, Myra became suddenly unresponsive. She was quickly examined by her team, who found that her right pupil was dilated and no longer reacting to light, and her body was making abnormal reflexive movements called decerebrate posturing in response to any kind of stimulation. All of these were signs that pointed toward impending brain herniation — a life-threatening shifting of brain structures due to severe compression.

Her team of doctors and providers acted quickly. She was intubated and put on a ventilator, given a dose of 23.4% saline (a concentrated salt solution to reduce the swelling in her brain), and her heparin infusion was stopped and reversed with an antidote presuming that she had had a bleeding event. She was then rushed to the CT scanner en route to the operating room for emergency neurosurgery. Imaging confirmed what had been feared and



Images capturing Myra's treatment journey.

“A year ago, I was thrilled to survive...and looked forward to what the future would bring. I would have never imagined a year from that day I would be getting ready to go to work in the midst of a pandemic,” Myra wrote on her blog nearly one year after the cranioplasty that would signify the beginning of the next chapter of her recovery.”

suspected: Myra had suffered a massive hemorrhage into her brain tissue that would require emergency decompressive surgery.

Myra has limited memory of her first week following surgery in the neuroscience ICU. Although her brain was the immediate concern, the rest of her body was part of the fight, too. Her ICU team would face several battles in the coming week. Her platelets, a special type of blood cell, and other blood proteins that help form blood clots, were found to be dangerously low due to an inflammatory response called disseminated intravascular coagulation that put her at risk for more bleeding. She also started having fevers from a severe pneumonia. Despite having just had a large hemorrhagic stroke, the ICU team had a difficult decision to make — when to restart her blood-thinning medication. Although her brain was healing, the large clot that caused her headaches was still present and not being treated. With the help of antibiotics and blood transfusions, Myra's infection and her low blood counts improved. The team eventually restarted her blood thinner after a repeat CT scan showed no new bleeding. At first, Myra would only wake up for brief periods of time and wasn't able to communicate. Soon, even this had improved: She was moving her arms and legs and giving the ever-optimistic thumbs up to the ICU team during daily exams. Everything finally seemed to be going in the right direction for Myra; it was almost time to remove the breathing tube.

She recalls her first concrete memory being a sea of unfamiliar faces gathered around her while she had her breathing tube taken out. She describes an incredible sense of frustration in being unable to articulate her own thoughts.

“I remember having rational thoughts...but it wouldn't come out of my mouth that way...it's like someone cut the brakes [to] your car.”

At times she recalls seeing faces, colors, and at one point an array of glowing fiber optic cables that she would later learn weren't actually there. For a woman who had always been a self-proclaimed “science nerd,” this was difficult to comprehend.

“I had no idea what was reality and if what was happening was real or still a nightmare.”

She experienced periods of anger and lability during this time, and it took seeing her scars in a mirror before she was able to grasp the extent of her injury.

Throughout everything that had happened, Myra's family was a point of constant comfort for her. They fueled her motivation to regain some sense of normalcy, though that would prove to be a moving target. She made great strides

even while she was in the hospital and left for acute inpatient rehabilitation 17 days after she first arrived in the emergency room, with only mild deficits in her arm strength and vision. Her stay at rehab was similarly brief, and she even graduated from home physical therapy just a week after leaving inpatient rehab. Her rehabilitation success was not without consequence, however.

"I tried to rush things as much as possible. Pushing myself too much, increasing my anxiety. You've got to give yourself a break, sometimes the body can't move as fast as you want it to."

Recovery: It's Not Just Physical

By all accounts, Myra has had a miraculous recovery. Her physical deficits are almost non-existent, and she has truly beaten all odds and expectations.

"She literally told me, 'I thought you were dead on the table,'" Myra says, recounting a discussion with her neurosurgeon. "[But] I can walk, talk, drive...what's been lasting has been the psychological aspects."

For Myra, like many other stroke survivors, there have been significant and unexpected psychiatric hurdles. These hurdles are the enduring aftershocks of her brain injury, and the trauma inflicted by critical illness and the ICU environment. There were periods of time when she felt so anxious and depressed that she couldn't even leave her house. She recalls being surprised in conversations with her neurologist, when she was told that anxiety was an expected complication.

"I don't think it was ever brought up...I remember saying, 'If it was going to happen, why didn't [we] treat earlier.'"

Myra's initial instinct was to intellectualize her experience by researching her diagnoses and her surgeries, but this

quickly led to more nightmares. Instead, she found counseling to be immensely helpful in restructuring some of her coping mechanisms and allowing her to heal from her trauma. Even after her cranioplasty, one of the last physical hurdles of her recovery, life had not returned to the same "normal."

"It had changed me, both physically and psychologically...my perspective on things had changed permanently," she recalls, endorsing a newfound self-confidence that simply was not part of who she was prior to her stroke. She felt rejuvenated as an individual and as a practitioner. "I now realized that life was too short to push aside your own happiness."

From Patient to Practitioner in the Time of a Pandemic

A year after her initial injury, Myra returned to work as a nurse practitioner. Despite her background, Myra frequently found medicine to be reductive as a patient.

"I felt like I was being treated like a series of scans on a screen," she recalls of the months long waiting time before her cranioplasty, which she suggested moving up. "I told them my concerns...even though the logical part of my brain knew it would be stupid."

Being an essential medical provider during this current health crisis, after so recently being a patient herself, has brought on some new hurdles.

"Especially now, with COVID-19 and intubation being constantly talked about daily...there is a lot of psychological trauma that comes along with an ICU experience," Myra explains. She counts herself as one of the lucky ones, however. Reflecting on her experience in comparison to that of current ICU patients, "It was awful going through it then, but I can't imagine how it must be now. I woke up to chaos, but I had some familiarity in the chaos."

At the current moment, when families cannot see their loved ones, and patients are critically ill on a scale that many of us have never seen before, Myra's reflections are a poignant reminder to us all.

"Going through everything from start to finish, the words are what I remember most. Little things that we say in the chaos of everything, a little word here or there, hope or something that we think is nothing, it could even be our tone of voice... it all matters." ●

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Members of Myra's care team.

Neurointensivists! Let's Step into the Frontline of the Coronavirus Battle Field

By Jeong-Ho Hong, MD, PhD, Department of Neurology, Keimyung University School of Medicine, Daegu, Korea



Jeong-Ho Hong,
MD, PhD

Recently, I was working as a neurointensivist at one of the hub-hospitals treating COVID-19 patients, Daegu Dongsan Hospital (branch hospital) and one of tertiary hospitals, Keimyung University Dongsan Hospital (main hospital), in Daegu, South Korea. Daegu is the center of South Korea's expanding COVID-19 outbreak.

Government-designated Hub-hospital for Only COVID-19 Patients vs. General Tertiary Hospital: A Neurointensivist's Point of View

Currently, the main hospital is treating some COVID-19 patients in a limited number of negative-pressure rooms, while patients who are not infected with COVID-19 are also being treated simultaneously. Due to this situation, sudden closure can often occur in general wards, ICUs, emergency rooms or examination rooms.

Presently, all patients admitted via the emergency room are required to conduct COVID-19 tests. Nevertheless, two neurologists self-isolated for two weeks after treating an acute stroke patient who had no fever or COVID-19-related symptoms but later tested positive to COVID-19.

After the admission of infected patients, other struggles for medical workers begin with having to change in and out of protective suits every time physicians examine each patient. In addition, patients who are not infected with COVID-19 are admitted and examined with so many restrictions, like practicing tests such as brain MRI, which are not available for public use due to secondary infection problems.

On the other hand, the branch hospital is a government-designated regional hub-hospital to treat patients with only COVID-19 infections. So, working conditions at this hospital are a little better, and it also has safer environment. For instance, from the entrance door of the hospital, medical staff should wear personal protective equipment, including anti-contamination clothing (level-D protective suit) and powered air-purifying respirator (PAPR) to protect against invisible viruses.

As there is no need to wear and take off protective gear repeatedly, there is a reduced risk of infection, and various tests can be conducted without any restrictions whenever physicians want, since they are only used by COVID-19 patients.

Yet, the main drawback is that wearing a PAPR or a level-D protective suit makes it difficult to work long hours, as doctors and nurses get exhausted easily. It requires lots of strength to work in this kind of suit for such a long period of time.

The Role of the Neurointensivist for COVID-19 Patients

The hospital initially received patients with mild symptoms but is now using its ICU, too, with the recent rise of gravely ill patients. Consequently, The Daegu Medical Association recruited medical staffs, and the Korean Society of Critical Care Medicine dispatched intensivists and experienced nurses to the hub-hospital, regardless of their affiliation or region. Now they have implemented a collaborative approach for ICU patients with COVID-19 infection. Several weeks later, ICU team asked

“Other struggles for medical workers begin with having to change in and out of protective suits every time physicians examine each patient.”



Addressing the COVID-19 crisis on the frontlines in South Korea.



Treating a critically ill COVID-19 patient.



Medical professionals working together, in full protective gear, in South Korea.

some neurointensivists to work together because ICU patients treated with ECMO, CRRT and mechanical ventilator had various neurologic complications. When I first went to the integrated ICU, one patient had epilepticus, and two other patients who didn't come to consciousness after CPR were already brain dead. More patients than expected needed detailed neurological examination and brain structure and functional monitoring, such as EEG and brain image.

“Acute cardiac injury or sepsis occur relatively often in ICU patients with COVID-19 compared to other medical or surgical ICU patients.”

Many ICU patients infected with COVID-19 have also neurodegenerative disorders, such as Parkinson disease, Alzheimer's disease, or some motor neuron disease and cerebrovascular diseases. Delirium was another big concern in the early and recovery stage of ICU management. Dr. Mao from China reported that about one-third of patients infected COVID-19 have neurologic symptoms, and this is more common in patients with severe infection.

Severe neurologic complications, such as acute cerebrovascular disease and conscious disturbance, especially occurred in the later

stage. Acute cardiac injury or sepsis occur relatively often in ICU patients with COVID-19 compared to other medical or surgical ICU patients. Therefore, neurointensivists need to step into the frontline of coronavirus battle field.

The Role of the Control Tower for COVID-19 Crisis

In the early days of setting up ICU, the biggest problem was the explosion of COVID-19 patients and their unexpected rapid deterioration, and the most important thing was the support of human and physical resources as soon as possible.

In this kind of situation, it is important for the academic societies and government to play the role of control tower in recruiting experts who can treat critically ill patients infected by COVID-19 from other regions, distributing them efficiently and identifying all critical patients in real-time.

In addition, cross-regional support of essential medical resources, such as ECMO, mechanical ventilators and PAPER were the driving forces behind the rapid treatment of COVID-19 patients.

Now, we also have to prepare to long-term battle against COVID-19 crisis. Exhausted COVID-19 fighters emerge as a foremost issue in a drawn-out struggle. On the day I drafted this article, Daegu reported zero new cases. However, more than 1,400 patients are still being treated in isolation, many of whom are being treated in the ICU. Daegu citizens will soon return to their daily lives, but we have to stay to the end and treat them. ●

Surviving COVID-19 as an Intensivist in a Developing Country

By Telmo E. Fernandez-Cadena, Intensive Care, Guayaquil, Ecuador; Manuel Jibaja, Intensive Care Unit, Hospital Eugenio Espejo, Quito, Ecuador; Nelson Maldonado, MD, Neurocritical Care, Universidad San Francisco de Quito (USFQ); and Miguel Andrade, MD



Telmo E. Fernandez-Cadena



Manuel Jibaja

Perspectives from Guayaquil, Ecuador

On Feb. 29, 2020, the first case of SARS-CoV-2 in Ecuador was announced in Guayaquil. What we saw as a distant problem in Wuhan and New York had finally arrived. A city hospital was enabled with 24 intensive care beds for COVID-19, and the opening of a hospital under construction was brought forward, which made us feel prepared.



Nelson Maldonado, MD



Miguel Andrade, MD

It turned out that this was not the case. The

key issue in those months was that our intensive care units were filled at 100% occupancy in both the public and private sectors, but the most shocking matter was that the first patients, and, therefore, the first deaths, were our colleagues. Intensivists with whom we recently had coffee or shared a conversation about some controversial case were in intensive care being intubated and struggling to survive.

There are more than 150 colleagues whom we will not see or consult any more. This led to a very serious problem: a shortage of trained personnel. This greatly limited the capacity to expand services in terms of the number of beds. This led to an unmet demand for health services resulting in deaths outside the hospital, abandoned corpses on the streets and rooms in houses converted into intermediate care units. As the demand for portable oxygen was so large, it did not matter if the oxygen tanks were for medicinal or industrial purposes. As long as it was oxygen, it worked.

Demoralized and depleted health personnel faced the pandemic. The protection equipment existed, but it was scarce and sold at triple the price relative to normal circumstances. President Trump's ban on exporting N95 masks (manufactured by 3M) to Latin America unleashed hoarding and speculation that is currently being sold informally at eight times its pre-pandemic price. In view of the abandonment of the United States government, we were forced to look toward China, and now the most used protective equipment in the country has the KN95 standard.

When the epidemic broke out in the city, it was at that stage that we tried everything that seemed to be appropriate at least in theory. We went through the stage of replication inhibition, depleting hydroxychloroquine (HCQ) and azithromycin stocks in pharmacies within hours, leaving patients with autoimmune disease without HCQ and the ones on antiretroviral therapy without lopinavir/ritonavir. Then to the immunomodulation stage with corticosteroids and tocilizumab to finally offer plasma from convalescent people, all with the aim of limiting mortality from severe COVID-19.

Saying that an intensive care service has a mortality attributed to COVID-19 of 40% can be interpreted as good performance. However, in the context of an unmet demand for medical care that results in an excess mortality of 15,000 people resulting in the world's highest per capita mortality rate, it is disgraceful.

In conclusion, the city of Guayaquil and its authorities were and have been unable to handle the epidemic. The flattening of the curve is attributed to the herd immunity that has been achieved with a very high price from the number of deaths. That immunity group death is the result of collapsed emergencies, the dead bodies on the street, lost bodies, mass and hurried burials. There is no way the decrease in cases can be attributed to the non-existent success of null management. We, in the intensive care units, had limited capability to expand our services in terms of the number of beds due to the lack of both human and financial resources. Half of our medical staff was infected, and this affected the availability of beds. We have learned that in a disaster situation, the city of Guayaquil has a lot to learn and develop, but it has been a lesson with too high a price, a lesson that will remain with us, tormenting us for a long time.

While the storm is easing in Guayaquil, it is raging in other Ecuadorian regions, so the city extends its hand. Today, intensive care units are at a 100% occupancy with patients from other regions. Guayaquil people will continue helping because we have tasted that bitter drink of losing family, friends and coworkers and because we know decisions to control the pandemic were made with political calculation instead of science-based evidence.

Perspectives from Quito, Ecuador

It has been months since the first description of the novel SARS-CoV-2 back in January, the continuous spread from its epicenter, how it took over China, Italy, Spain, The United States and now, South America.



Medical professionals battling to ease the pandemic in Ecuador are struggling against a hostile environment with many external factors working against them.

Since the first case was reported in Guayaquil, Ecuador, an impressive number of cases were registered, overtaking health services response capacity. They asserted an enormous workload on the medical services, especially the intensive care units.

Furthermore, Guayaquil City and the Guayas Province became recognized around the world by the press, some even referring to it as "Latin America's Wuhan."

At the same time, I was working in the ICU at Hospital Eugenio Espejo in Quito, Ecuador. It is the country's largest public health hospital. We became first-hand witnesses to the events developing in Guayaquil, foolishly thinking that our fate was different.

Sadly, this unprecedented sanitary crisis presented itself at the country's worst economical situation in the past decades. As revealed by the World Bank Group data, Ecuador holds the seventh position for income per capita in South America.

It was not until March 9, 2020, that the first COVID-19 case was reported in Quito. The patient was hospitalized in our ICU with a severe case of ARDS and shock state. Since then, the case report incidence has progressively risen in a worrisome manner.

The attention given to ICU patients in a medium income country conforms a peculiar scenario, requiring the development of a certain set of skills that would not be necessary in places of wealthier resources. Specifically, the quantity of ICU beds

available per 100,000 habitants are abysmally different. For example, at the beginning of the pandemic, Germany and the United States disposed of 33 and 30 beds, respectively, while Ecuador held seven.

Today, ICUs in Quito are reaching maximum capacity, and some are even overflowing due to COVID-19. Hospital Eugenio Espejo provides service to the economically challenged population who have no health insurance. The hospital expenses are covered by the state's budget. Adversely, the state's main source of income is oil, which is at its lowest cost in history. It is obvious we are not only fighting COVID-19.

Nevertheless, I have worked nearly three decades in critical medicine. To the date, I cannot remember a more hostile environment from what we are experiencing today. A gigantic amount of information is transmitted every minute, scientific publications have set an alarming and suspicious record. Mechanical ventilators now are as mainstream as football, and the quantity of COVID-19 experts is overwhelming.

The main lesson government authorities of developing countries have to learn during this pandemic is that we must channel resources to public health immediately. Regardless of the political party in power, hospitals, especially those treating the most vulnerable, must be in top condition to perform if we want to avoid unprecedented catastrophes. ●

On the Frontline of COVID-19 in Qatar: Navigating Through Crisis, Embracing Change and Leading Innovation

By Ahmad Abdussalam, MD, MRCP UK, neuro intensivist, UCNS Certified; Dana Bakdach, BSC, PharmD, clinical pharmacist; Sundus Sardar, MBBS, medical resident; Nadir Kharma, pulmonary critical care and sleep medicine; Ali Ait Hssain, MD, DESAR, ECMO consultant; Adel Royce Mangodato, senior RN; and Ashraf Molokhia, MD, consultant intensivist and anesthetist



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In Qatar, the first case of COVID-19 was confirmed on Feb. 27, 2020. While the global death toll continues to climb, Qatar stands out with a low mortality rate of 0.14%, and 150 deaths to date.¹

The state of Qatar is located in West Asia in the Arabian Peninsula, with a population of less than 3 million. It has invested in an excellent health service and had ranked in the top five worldwide in 2018 according to the UK-based Legatum Prosperity Index™.² With more than three months into the uncharted territory of the COVID-19 pandemic, Qatar has risen to the challenge with innovative multidisciplinary strategies to navigate through this crisis.

Amidst the myriad clinical presentations of COVID-19, predominantly with respiratory, gastrointestinal, renal or cardiac involvement, recent emerging data on neurological manifestations of SARS-CoV-2 have incited significant interest. In patients exposed to SARS-CoV-2, approximately one-third may present with neurological manifestations, including dizziness, headache, impaired consciousness, acute cerebrovascular disease, ataxia, seizure, ageusia, hyposmia, anosmia, vision impairment, nerve pain and skeletal muscular injury manifestations.³ Stroke, cerebral venous thrombosis, encephalitis, Guillain-Barre syndrome, hemorrhagic necrotizing encephalitis, meningitis and epileptic seizures have also been reported.⁴

Our neurocritical care service was established in 2017, fully resourced with an on-site intensivist with continuous access to neuro-interventional radiologist, neurosurgeon, neurologist and a stroke service. We have 24/7 access to CTs (including CT perfusion with RAPID software), MRIs and portable video EEG. We have established structured training program for our neurocritical residents, fellows and critical care nurses. Additionally, we have started introducing Emergency Neurological Life Support (ENLS) and Neurocritical Care Society (NCS) guidelines. The above

expertise, resources and training have enabled us to manage all neurocritical care complication of COVID-19 expeditiously.

Similar to the other human coronaviruses (MERS-CoV and SARS-CoV), definitive antiviral therapy against 2019-nCoV has not yet been identified.⁵ Hence, besides early supportive care, the management of severe life-threatening cases relies heavily on implementing the standards of intensive care management (eg, adequate analgesation, early protective ventilation, etc.) along with utilization of evidence-based therapies to treat the underlying pathology.

In our center, the protocol of managing critically ill COVID-19 patients is continuously being reviewed and updated to reflect the available evidence. Alongside supportive and standard intensive care support, drugs targeting different viral structures and functions have been prescribed (including lopinavir/ritonavir, ribavirin, interferons and others). The early use of immunomodulators (including steroids or tocilizumab) have been advocated yet the decision has been left to the discretion of the treating physician based on the individual case scenario. Finally, convalescent plasma therapy was recently introduced and is utilized in some severe cases as an alternative.

Throughout their ICU stay, similar to previous publications⁶, we have noticed several pulmonary complications among COVID-19 patients, including pulmonary embolism, ARDS, pneumonia, pulmonary hypertension, spontaneous pneumothorax and pneumomediastinum. The majority of patients who develop pneumothorax seem to be healthy at baseline with no comorbid conditions. Many of them developed spontaneous pneumothorax, following the use of invasive or non-invasive positive pressure ventilation (PPV).

Mainly due to respiratory complications of COVID-19, our referrals for extracorporeal membrane oxygenations (ECMO) have jumped



Keeping motivation high while fighting the COVID-19 pandemic in Qatar.

by almost six-fold. Despite revising our usual criteria for a more conservative approach, we increased our ECMO capacity to more than 200%. Expedited training was organized for three different ECMO devices and physician and nursing rotas were amended to meet the patient demand. During these longer than usual ECMO runs, we saw several pregnant patients, a high number of pneumothoraces, pulmonary embolisms and patients requiring support by VA ECMO.

COVID-19 is well known for a high incidence of thrombotic events, including pulmonary embolism and myocardial injury. A D-dimer level greater than 1 µg/mL has been identified as a risk factor for poor outcomes in COVID-19 patients.^{7,8} Despite all patients in our ICUs being treated with at least an intermediate dose of anticoagulation if the D-dimer level exceeded 1.2 µg/mL, and high risk patients with acute worsening in oxygenation, dead space or rapid rise in D-dimer (>5 folds in 48 hours) are started on a therapeutic anticoagulation regimen, the authors have seen several patients with pulmonary embolism among COVID-19 patients in ICUs in Qatar.

Similar to healthcare systems across the world, staffing requirements to meet the surge of patients has been challenging in Qatar. To meet the extraordinary challenges created by the COVID-19 pandemic, our dedicated healthcare team came together in the spirit of commitment and solidarity, with a shared sense of purpose that has strengthened the entire healthcare team. Coping strategies including lifestyle modifications, and psychological adjustments were introduced to deal with the added stress of wearing restrictive personal protective equipment (PPE) for long periods.

We have worked in new environments and integrated harmoniously with new teams sharing a common goal of

protecting and treating our patients. Our multidisciplinary team have continued to innovate, research and update our therapeutic strategies to play a crucial role in fighting the pandemic that has left no place on earth untouched. ●

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Research Operations Subcommittee Update 2019-2020

By Shraddha Mainali, MD; Molly McNett, PhD, RN, FNCS; Sherry Chou, MD, MMSC, FNCS; Jennifer Kim, MD, PhD; Tom Lawson, CNP



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The Research Operations Subcommittee (ROSC) of The Neurocritical Care Society (NCS) has continued to support research initiatives throughout the society. Within the past year, the subcommittee has primarily provided operational support for two main projects:

- I. The Curing Coma Campaign (CCC)
- II. The Global Consortium Study of Neurological Dysfunction in COVID-19 (GCS NeuroCOVID).

The Curing Coma Campaign (CCC)

CURING COMA
AWAKENING HOPE

NCS has taken up the grand challenge to “Cure Coma,” which was

officially announced at the NCS 17th Annual Meeting in Vancouver in 2019. The scientific steering committee and the NCS research core (Neurocritical Care Research Network (NCRN), Neurocritical Care Research Network (NCRN)/Mission Control and the ROSC) have continued to work on building the foundation and paving the path to accomplish this colossal mission, despite the unprecedented challenges brought upon by the pandemic.

The ROSC is committed to supporting the CCC by providing logistical support and coordination of various elements of the campaign. Early in the development of the initial campaign, the ROSC collaborated with NCRN to identify representatives from ROSC to serve within the central coordinating component of CCC, “Mission Control.” Integrating ROSC representation into Mission Control will aid in streamlining communication among various workgroups within the CCC and mobilize additional infrastructure components that may be needed rapidly as the initiative continues to grow. For example, as the CCC began to initiate specific modules and identify individuals with expertise to serve on these teams, the ROSC survey taskforce quickly developed a “call for volunteers” to begin creating a central database of interested volunteers.

“Within this pandemic, there is an emerging body of literature reporting on various neurological dysfunctions associated with COVID-19 infection.”

Most recently, the ROSC website taskforce has updated the NCS research website to provide specific links to the CCC website and materials.

Global Consortium Study of Neurological Dysfunction in COVID-19 (GCS NeuroCOVID)

The COVID-19 pandemic continues to surge globally. Within this pandemic, there is an emerging body of literature reporting on various neurological dysfunctions associated with COVID-19 infection. Multiple reports have suggested a spectrum of mild to severe neurological illnesses in patients with COVID-19, including headache, encephalopathy, hyposmia/anosmia, dysgeusia/ageusia, meningitis/encephalitis, seizures, coma, Guillain-Barre syndrome and acute cerebrovascular events. Neurocritical care teams are uniquely positioned to gather data to better understand the prevalence, mechanisms, phenotypes and prognostic implications of COVID-19-related neurological dysfunctions. Recognizing the existing knowledge gap in areas pertaining to our specialty, a team of neurocritical care experts within ROSC leadership team rapidly developed research protocols to evaluate these gaps in a systematic manner and coordinated with other members of NCS to launch three active studies:

1. Neurocritical Care COVID 19 Outcomes Study

This prospective, multicenter global observational study aims to evaluate the impact of COVID-19 on outcomes of adult neurocritical care patients. This study will focus on five major neurological and neurosurgical conditions managed in the NCCU:

- » Ischemic stroke
- » ICH
- » SAH
- » TBI
- » Status epilepticus

All patients with the relevant diagnoses, regardless of COVID-19 status will be enrolled in the study. To date, there are 83 global sites enrolled in this study. Enrollment is ongoing and interested members can sign up to participate on the NCS COVID Research webpage.

2. Global Consortium Study of Neurological Dysfunction in COVID-19 (GCS-NeuroCOVID): Adult Study

The Global Consortium Study of Neurological dysfunction in COVID-19 (GCS-NeuroCOVID), has been established with the goal of understanding the global prevalence, pathological mechanisms and outcomes of neurological dysfunctions associated with COVID-19. This pragmatic study is designed to be launched in a three-tiered approach with basic prevalence data collection in the first tier and inclusion of more granular details and higher complexity study designs in higher tiers. This approach will allow for adjustment and addition of pertinent new neurological findings in higher tiers as new neurologic manifestations surface over time. As of late July 2020, there are 123 sites, including 44 countries and six continents registered for the Tier 1 study. This study is open for enrollment and interested investigators can register their sites for participation through this portal:

The Tier 2 study consists of prospective collection of functional and cognitive outcomes with greater details of clinical, laboratory and radiographic data performed as part of standard of care. The Tier 3 study involves the high complexity design including collection of experimental biospecimens, such as blood and cerebral spinal fluid (CSF), advanced electrophysiological and imaging analysis, as well as longitudinal outcomes assessment. A team of global experts has been assembled to form scientific working groups to finalize the data elements for Tier 2 and Tier 3 studies, which are currently being finalized.

3. Global Consortium Study of Neurological Dysfunction in COVID-19 (GCS-NeuroCOVID): Pediatric Study

In parallel to the adult study, a multicenter pediatric core has established a three-tiered pediatric arm to this global research consortium with the aim of capturing prevalence of neurologic dysfunctions in pediatric population, to evaluate specific neurological dysfunctions associated with COVID-19 and to examine patient outcomes related to these dysfunctions. The Tier 1 pediatric study is active for enrollment through December 2021 and involves data collection from the medical record during the hospital stay. Tier 2 and 3 are actively being developed. To date, 99 sites have registered for the Tier 1 study globally.

The COVID-19 research initiative is endorsed by the NCS and a brief description of all studies with registration links can be found on the NCS website: <https://www.neurocriticalcare.org/research/covid-19-research-opportunities>.

“A team of global experts has been assembled to form scientific working groups to finalize the data elements for Tier 2 and Tier 3 studies.”

The GCS NeuroCOVID study team has established a formal partnership with the European Academy of Neurology, expanding the number of registered sites to over 400 locations globally. Additionally, the project has recently been supported by the Latin American Brain Injury Group (LABIC) to expand access to study materials throughout South America. Members of the study team and ROSC have also been invited to join the Brain Initiative Forum of The World Health Organization to work toward global harmonization of core data elements that will be included in assessments and research regarding neurological manifestations of COVID-19. Harmonization of core data elements across sites and resource settings through these partnerships is imperative to accurately record data on the prevalence, severity and outcomes associated with COVID-19 infection on a global platform.

For a detailed description of the GCS NeuroCOVID study, please review the methods paper published in *Neurocritical Care*.¹ ●

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“Harmonization of core data elements across sites and resource settings through these partnerships is imperative...”

New Simulation Content for Emergency Neurologic Life Support® (ENLS)

By George Lopez, FNCS, MD, PhD; Chitra Venkatasubramanian, MD; and Sarah Peacock, APRN, DNP



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We are excited to announce that after much consideration and evaluation, Emergency Neurological Life Support® (ENLS) will receive a major upgrade in Fall 2020! NCS has partnered with Designing Digitally, a company that specializes in simulation content to build several virtual simulation cases in the online ENLS course. Virtual simulation has gained popularity in healthcare and throughout education as they help learners integrate information in a safe manner. We anticipate the developed self-paced simulation cases will help enhance and solidify the learner’s application of the ENLS material in an interactive and fun learning environment.

This project is the culmination of several years of work on behalf of multiple volunteer members. Our task force first evaluated if simulation was perceived as beneficial and an added value to the ENLS course. We received an overwhelming affirmative feedback (> 90%) from NCS members and ENLS learners across the globe. Our next step was to solicit mock simulation content from multiple simulation companies, which were vetted by the task force. After selecting Designing Digitally, the task force members then brainstormed about what ENLS content represented high value for our learners and would easily lend itself to online simulation. We identified six high-impact modules, including acute stroke, traumatic brain injury, ICH and coma, meningitis and acute weakness. The selected scenarios and modules represent the most common neuro-emergencies encountered across the globe and where providers of neurocritical care from all backgrounds can play a vital role in improving outcomes in the golden hour. The task force then

wrote simulation cases and scenarios to be built into the virtual environment. This was a multidisciplinary effort to create content that will be useful to all levels of learners from all disciplines. We also worked with international NCS members to ensure content was beneficial to providers across the globe. We are excited to launch this offering at no additional cost at the Annual Meeting in September 2020. We are excited to have ENLS course participants take these self-paced modules and give us feedback that we can use to refine the scenarios and build additional cases.

“We are excited to have course participants take these self-paced modules and give us feedback that we can use to refine the scenarios and build additional cases.”

While this project focused on creating simulation cases in the virtual environment, we recognize the need to create case content to be used in-person with high-fidelity equipment. Such cases could be paired with live courses to allow attendees to apply the content. The next stage of the simulation project is planned to include content for this purpose.

Over the years, this work evolved with the help of numerous NCS members with passion for education and ENLS. We could not have accomplished this project without the help of many individuals, including (in alphabetical order) Chinar Agarwal, Wendy Chang, Barry Czeisler, Deepa Malaiyandi, Nick Morris, Christa O’Hana Nobleza and Chris Robinson. We are also deeply thankful to our NCS-ENLS staff team of Tissy Greene, Becca Stickney, Bonnie Rossow and Mario Russo. ●

“The selected scenarios and modules represent the most common neuro-emergencies encountered across the globe.”

Training Pathways for Neurocritical Care Advance Practice Providers

By Erika Bassett, PA-C; and Alexis Steinberg, MD



Erika Bassett, PA-C



Alexis Steinberg, MD

When graduating from a nurse practitioner or physician assistant program, an advance practice provider (APP) can launch themselves into a broad range of specialties and subspecialties. So why enter

the world of neurology, and specifically, why neurocritical care?

Throughout the years, we have seen APPs come and go in our neurological ICUs (NICU). Some enter neurocritical care, learn the nuances of neurological patients, but ultimately leave and transition themselves into a different subspecialty. Conversely, there are the APPs who stay and immerse themselves in the care of the neurological patient and find purpose and satisfaction in their work.

So, why do some APPs stay and others leave? How do we train our APPs for success, prepare and retain them for a long, accomplished career in neurocritical care?

The demand for APPs in ICUs has increased over the past decade secondary to both ACGME guidelines limiting resident duty hours and fewer physicians subspecializing in critical care medicine. The increase of APPs in ICUs has resulted in exploration of methods and training options to adequately prepare incoming APPs. Currently, there are no specific or standardized training programs for APPs who are pursuing a career in neurocritical care. The training mechanisms for APPs tend to have wide variations of exposure to patients with acute brain injury. We have reached out to three APPs who have taken different pathways to a neurocritical care career for their insight of what has helped their success along the way.

Introductions to the NICU

First, how does one first step foot into the world of neurocritical care?

It seems some are introduced at a point prior to the completion of their advanced practice provider degree. Pat Coppler, PA-C, of University of Pittsburgh, Department of Emergency Medicine and the Post Cardiac Arrest Service, worked in post-cardiac arrest research prior to pursuing his education to be a physician assistant. He felt this made him “gravitate” toward neurological specific units.

“I find the pathology, specifically, neurotrauma and anoxic brain injury both interesting and rewarding to care for,” he says.

For Megan Brissie, doctoral, ACNP-BC, RN of Duke Regional Hospital, “I first became interested in neurocritical care when I

was a nursing student at the University of Cincinnati. I had the opportunity to rotate through the Neuroscience Intensive Care Unit when I was a fourth year nursing student. At the time, Dr. Lori Shutter was one of the neurointensivists at The University of Cincinnati. Between the complexity of the patients, uncertainty of their outcomes and opportunity to make a difference in patients’ lives even in the midst of tragedy, I knew that I wanted to work in neurocritical care one day. Therefore, after working in trauma as an emergency nurse for three years, I returned back to the University of Cincinnati and entered into the acute care nurse practitioner (ACNP) program with the ultimate goal of becoming a certified nurse practitioner who would work in the inpatient setting and knew that I would one day work in the neurocritical care.”

Candi Hicks, MSN, AGACNP-BC of Vanderbilt University Medical Center, started her career as a neurosurgery nurse practitioner and developed a relationship with the critical care team through this experience. She credits her continued career in neurocritical care largely to her supportive working environment.

“Why do some APPs stay and others leave? How do we train our APPs for success, prepare and retain them for a long, accomplished career in neurocritical care?”

Training and Preparedness

Of the multiple challenges faced when entering the world of neurocritical care, one obstacle is particularly daunting: understanding critical care management and multi-organ support in the setting of the complex physiology of acute neurological illness. So, how are APPs trained for success?

Megan and Pat both had training in other units prior to starting their career in neurocritical care. Pat completed a 12-month APP critical care residency program by rotating through different, diverse ICUs. He stated that “During that time, I was treated as house staff with the expectation to make and carry out a plan of care for established patients, work up incoming patients and perform all necessary procedures. After that year of training, I started practicing in the neurotrauma/neurovascular ICUs without further formal orientations.”



Neurocritical care advance practice providers (left to right) Pat Coppler, PA-C; Cecelia Ratay, CRNP; and Erika Bassett, PA-C.

Megan describes her diverse ICU exposure during her orientation, “I had the opportunity to practice in several different ICUs, including the Neuroscience Intensive Care Unit. Our program also allowed for a two-week intensive in the Surgical Intensive Care Unit, where it was the expectation that we, too, worked alongside our medical colleagues and spent 80-hours per week in the ICU. In addition, I had the privilege of working with the Cincinnati Stroke Team and learning more about the acute management of ischemic stroke during my training.”

In contrast, Candi had a more focused orientation process during her transition into neurocritical care. “[I had] 12 weeks of orientation to the unit, each week discussing each patient population on the unit.”

These three APPs gained confidence in their clinical decision making through different experiences. Pat felt his exposure to different patient populations outside of the NICU provided him with a more comprehensive approach to patient care and the confidence to take care of neurocritical care patients. Candi credited a large supported, teaching environment as the reason for her success in the NICU. For Megan, confidence came with time, “Although I felt prepared to enter into clinical practice as an acute care nurse practitioner, it was not until I was several years into my practice alongside a team of fellow APPs that I felt confident in my clinical practice as an APP.”

Obstacles Along the Way

We all have obstacles our everyday lives, but what were the specific neurocritical care obstacles that the APPs have experienced along the way?

Megan explains, “There was no standardized orientation or training specific to neurocritical care for APPs when I entered into neurocritical care in 2011. The majority of specialized training for this complex patient care was received during my clinical practice. Although NP training is geared to train APPs to be competent providers, due to the complex nature of neurocritical care patients, I personally felt that it took me more time to better learn this population to meet their care needs. One that I was fortunate enough to receive and was highly supported by my fellow APPs and attendings in my clinical practice setting.”

Pat felt having to compete amongst fellows and residents for his learning could be frustrating at times. For Candi, her background in neurosurgery started her off strong, but she felt learning the intricacies of neurology was more challenging than she expected.

Room for Improvement

We asked these three APPs about what changes should occur to improve training for APPs interested in neurocritical care?

Pat reiterates the importance of comprehensive training, “It might just be because of my background, but I think neurocritical care APP training should include rotations in a number of other intensive care units. I find it valuable to learn approaches to pathology that we don’t see as often in the NICU (hemorrhage, ARDS, etc.) from units that see a high volume.”

Megan comments on the advancements in neurocritical care education tools.

“Over the years, I have been amazed to watch the development of educational resources by the Neurocritical Care Society (NCS),” she says. “I remember taking part in Emergency Neurological Life Support (ENLS) when it was first offered in Denver. To see how this program has continued to develop and evolve over the years has been amazing. NCS is highly focused on educating all their members and ensuring that all members of the multidisciplinary team are recognized and educational needs are met. This is seen in the development in such products as the Pocket Guide and OnCall. Additionally, the APP Committee has been focused on creating materials geared at supporting APP through the development of webinars geared at neuroimaging and neuroanatomy and the development of an Orientation Guide to assist with onboarding new APPs to the neurocritical care unit by utilizing resources created by the NCS.”

As more APPs are integrated into the neurocritical care team, the question remains: What is the best method to adequately prepare new APPs who enter the field?

Neurocritical care APPs provide significant value to the ICUs they serve, thus it is important to ensure adequate training and to impart the confidence necessary to provide care for this complicated patient population. Does there need to be dedicated neurocritical care fellowship training programs for APPs? Or should training include focus on a more general critical care population? Should there be guidance from medical societies on the onboarding process for and utilization of APPs?

Regardless, it is clear that the utilization of training tools and exposure to patients outside the NICUs, combined with supportive training staff may be essential for preparing an APP for a long career within this highly specialized but also extraordinary specialty of medicine. ●

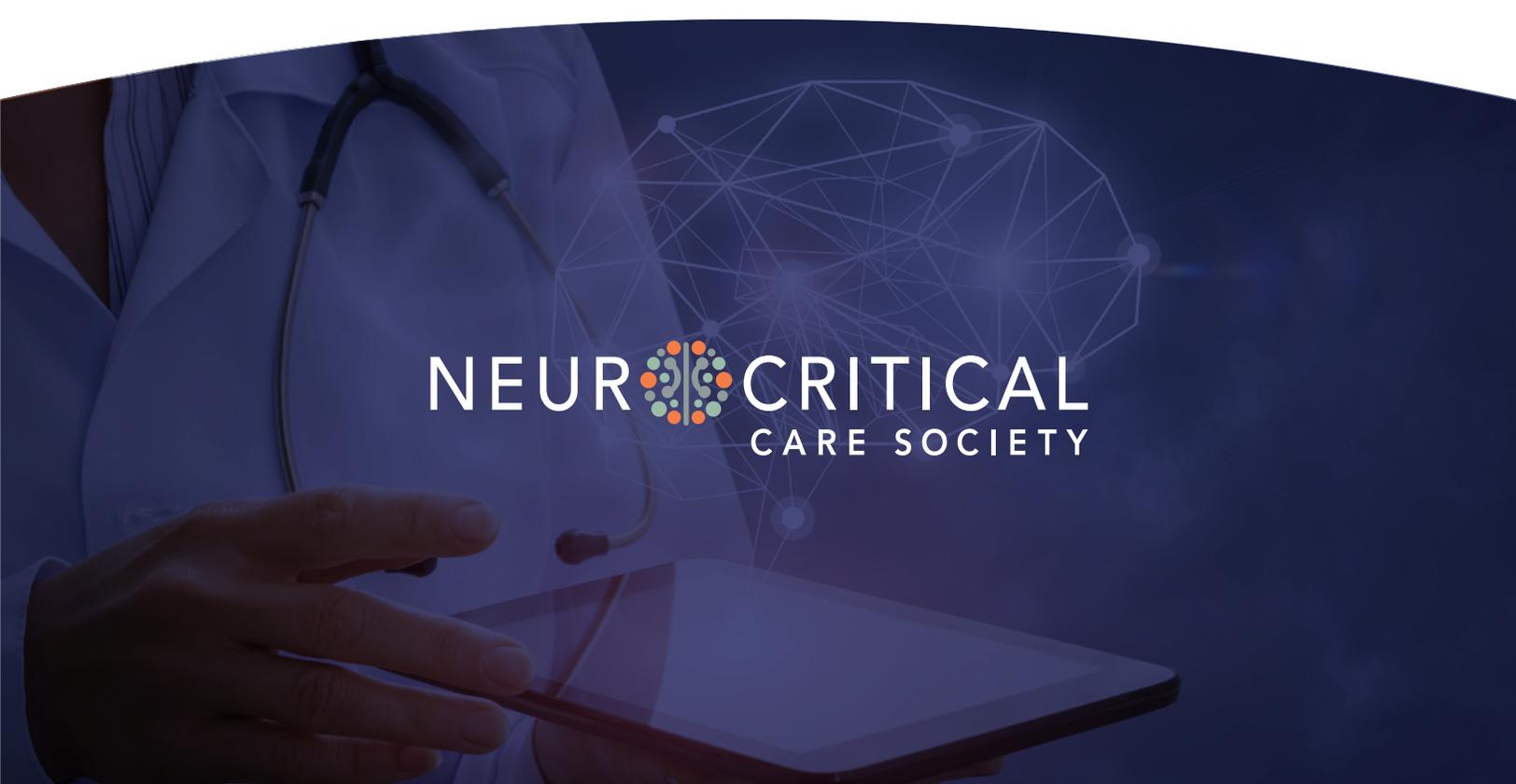


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Taking a Closer Look into Neurocritical Care Mechanical Ventilation During the COVID-19 Pandemic and the Use of Anesthesia Machines in the Neuro ICU

By Shaun Golden, MSN, RN; and Sarah Beth Thomas, MSN, RN, CCRN, CNRN, SCRN



Shaun Golden,
MSN, RN



Sarah Beth
Thomas, MSN,
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Since the beginning of the COVID-19 global pandemic, ventilators have been at the forefront of public discourse. Discussions on social media, stories in various news outlets and even sound bites offered by prominent

politicians in Washington and beyond have made ventilators a new buzzword for the American public. As Governor Andrew Cuomo of New York said in a March 18 press briefing: "It's all about the ventilators." The media continues to support the notion that if there are enough devices, people's lives would be saved. Those of us in the realm of critical care know that this novel virus isn't dependent on the utilization of ventilators to best treat the disease.

“Those of us in the realm of critical care know that this novel virus isn't dependent on the utilization of ventilators to best treat the disease.”

It is our experience in neurocritical care that tells us that the mortality and morbidity of our patients does in fact rely upon the availability of mechanical ventilation. Respiratory management and the use of protective ventilation in early phases of brain injury, such as TBI, ICH or strokes, is critical in preventing secondary hypoxia, hypotension and hypercapnia. Despite numerous clinical studies, the safest ventilatory setting has yet to be established in reducing the risk of ventilator-induced lung injury (VILI), impaired cerebral venous drainage, intracranial hypertension and increased ICP.



The authors changed the ventilators in the neuro ICU over to the Dräger Apollo anesthesia machine for a preemptive trial.

During an extreme resource-limited pandemic, the inability to overcome several obstacles, like equipment, infrastructure and human resources, would inhibit delivering high-quality ventilatory care. In the event of a shortage of ICU ventilators, is getting an anesthesia ventilator versus not getting a ventilator an option? Should this even be a consideration when we have anesthesia machines sitting idle in the OR? A risk-benefit assessment on the use of an anesthesia device for long-term ventilation was imperative. Weighting the risk of the off-label usage of a Dräger anesthesia device against benefit of being able to ventilate a patient in crisis is the right decision.



Members of the nursing/ICU team at Brigham and Women's Hospital in Boston.

We utilized a true multidisciplinary approach to think outside the traditional "box," and we successfully collaborated with our procedural colleagues from anesthesia. We changed the ventilators in the neuro ICU over to the Drager Apollo anesthesia machine for a preemptive trial. Our decision for this trial was the use of anesthesia machines as ICU ventilators on patients who were not COVID-19 positive to reduce the risk of the rebreathing system becoming a COVID-19 vector.

This all became possible on March 22, 2020, when the FDA issued guidance outlining a policy intended to help increase availability of ventilators as well as other respiratory devices and accessories during the COVID-19 pandemic. This policy was effective immediately.

The change to anesthesia machines in the ICU also necessitated a change in workflow. An anesthesia professional needed to be immediately available at all times (24/7/365) to manage the anesthesia machine as an ICU ventilator. Intensivists, ICU nurses and respiratory therapists are not trained to manage anesthesia machines, so CNRAs and anesthesiologists were deployed to the ICU to provide this support.

Quick to react to the pandemic, a joint committee representing the ASA, APSE, SOCCA and SCCM developed the educational program: COVID Activated Emergency Scaling of Anesthesiology Responsibilities (CAESAR) ICU project. The industry was also quick to react, and clinicians are directed to the manufacturers' websites for specific instructions on safe use of anesthesia gas machines for this new long-term indication.

Our experience using anesthesia ventilators over a 10-day period was a very positive. The biggest concern that was identified was the increased staff, with associated cost, that is needed to safely operate the anesthesia machines in the ICU setting. From our trial, we are confident that any patient needing ventilatory support can be ventilated with anesthesia machines capable of providing controlled ventilation or assisted ventilation. While this may be outside of the traditional use of anesthetic indication, by following recommendations and guidelines of FDA, industry, professional societies and hospital policy anesthesia machines can be used in the Neuro ICU if needed during a resource shortage generated by a pandemic. ●

Reflections From a Deployed NYC COVID-ICU Nurse Practitioner

By Mary Presciutti, NP, CCRN, CNRN, Mount Sinai Hospital, Department of Neurosurgery



Mary Presciutti, NP, CCRN, CNRN

Weeks before deployment, my fellow advanced care providers (APP) and I were told that our New York City hospital was in the process of rearranging healthcare personnel to meet the impending surge of patients with COVID-19. Like most of us, I was filled with anxiety and many questions: How will things be? What will our path be moving forward?

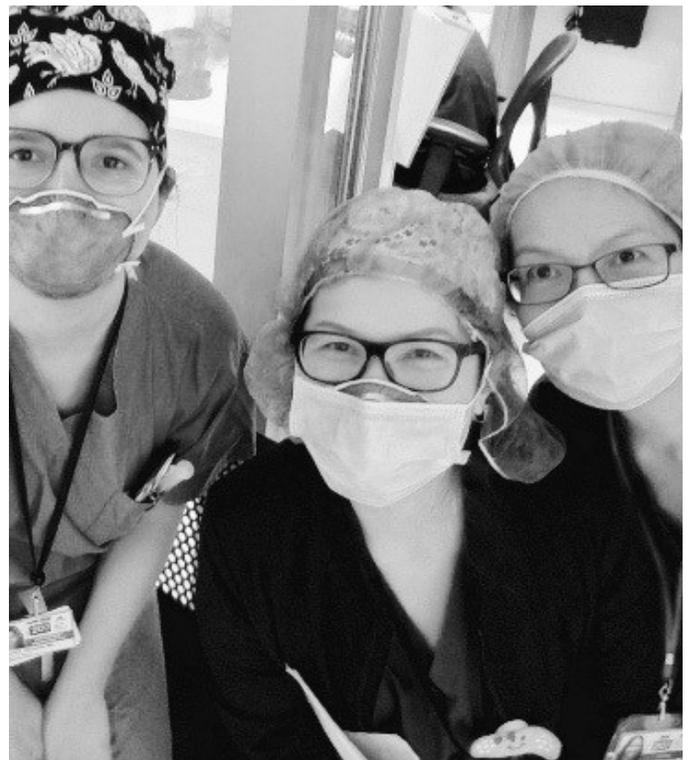
Two weeks later, I received my schedule and learned that I had been assigned to the COVID-ICU. Prior to my current position as a nurse practitioner (NP) in neurosurgery, I worked as a bedside critical care neuroscience nurse in a university hospital for two decades. Having left critical care for almost four years, I was certainly filled with worry and apprehension.

On my first day in the COVID-ICU, I was grateful for having been paired with a senior critical care NP. Upon entering the unit, my fight-or-flight response was immediately activated. I will never forget the first time I had to wear full PPE. With emotions raging, I had to tell myself, "I can do this."

It was difficult and certainly overwhelming in the beginning. We worked all day as admissions came, one after another. I had read the experiences in Italy beforehand, and it was clear that the virus had arrived in full force in our ICU. By the end of my first shift, we had seven admissions and two emergency intubations. My colleagues and I were amazed, wondering what lay ahead.

“I will never forget the first time I had to wear full PPE. With emotions raging, I had to tell myself, 'I can do this.'"**”**

As days turned into weeks, we grew as a team. Different physicians, surgeons, APPs and nurses joined our team. Some of us would gather in the middle of the nurses' station at the beginning of our shifts for a brief meditation. Soon after, more formal meditation and health-caring stations were set up.



In the midst of the pandemic, the author and her colleagues took time to pose for a few photos (even if smiles were covered by face masks).

Below are the text messages I shared with my colleagues at the end of each week, following my second week on duty.

Week 2:

Thank you, team, for your CHARITY and VALOR.

Week 3:

Grateful to have seen the TRUE ART of medicine on display. Amazing work despite the great hazard we face. Forward march into the next week.

Week 4:

We continue to heal and comfort the sick (patients and families), though I am becoming more aware that it is they who heal us INTERIORLY. As the new week unfolds, I am reminded to embrace my fears, and am paradoxically EMBOLDENED to be CENTERED, weighted, balanced.

Week 5:

Cheers and celebration! We discharged our XX-year-old patient to her home with support. These victories stir our hearts with hope; though we don't forget those who were LOST to the virus.

COVID-ICU has imbued a NOBLE FELLOWSHIP, a living history of service and dedication.

Week 6:

Thank you to our colleagues (physicians/surgeons/APPs) who joined us in the fight against COVID; for being a part of the XX community. As you move on, note that I learned so much from you, therefore, I am better. Those of us remaining here, we will continue to battle in a concerted effort, in tune to the rhythm of the virus.

Presently STEADFAST; deeply GROUNDED in HOPE.

Week 7:

We continue to care for those IMPRISONED by the virus. Through this experience has arisen a profound appreciation of the gift of good health, FREEDOM from illness.

Week 8:

As the DARKNESS of the pandemic begins to shed, we continue to walk with constancy in hope; in blinding CLARITY.

Week 9:

Despite the virus straining us, we must remember that it is HOPE that lifts and animates. Take care and be well!

We also huddled before starting our shifts, tuning in to our colleagues' needs and acknowledging the different specialties on board. We were fortunate to have rounded with attendings who reminded us of positive events in all that we did. Being with a great leader made all the difference. They carried an invisible sign of hope on their forehead, right on top of the thick face shield. One can see the smile behind the masks, if one gazed at the side of their eyes. One memorable example of this was when one of our attendings asked us, "How can I support you so that things are a little easier?"

“How do you reconcile with letting go of your loved one when you cannot be with them for their last minutes of life?”

The virus definitely imbued a noble fellowship as we treaded along. Respect for each discipline and appreciating each other's strengths were part of the recipe for success. After each huddle, we went off in teams, always making sure everyone was doing OK.

Some of our team members worked remotely, updating families on the phone since the patients could not have any visitors. Zoom visits quickly became the norm. I had participated in one memorable family Zoom conference for a patient who was close to death. The patient's family told us about the patient's life prior to being sick. There were many tears shed — their love was palpable. How do you reconcile with letting go of your loved one when you cannot be with them for their last minutes of life?

Shifts increasingly became difficult as death seemed to surround us. At the end of each week, I began to share messages of encouragement with my colleagues in our group text, hoping to lift their spirits — not in false optimism but in hope. This virus has affected all of us in more ways than we can ever know. I kept reminding myself, "Now, more than ever, is a period of reflection and meaning." I suppose that was my coping mechanism.

I have gone back to my regular post in the neurosurgery step-down floor. Working in the COVID-ICU for 9 weeks, I found that working together as a team brought out the best in all of us. We worked with a common denominator, the purpose of why we chose to be in healthcare: to love and care for our patients. I often think about our patients and their families, those who we lost, those who survived and those still facing a long recovery.

I am glad to be of service, to have cared for others and to have loved my patients. I am glad I was deployed. I return to my regular post in peace and gratitude. ●

A New Era for Pharmacy in Neurocritical Care: The Neurology-Trained Clinical Pharmacist

By Brittny Medenwald, PharmD, with acknowledgements to Katleen Chester, PharmD, BCCCP, BCGP; and Sunita Dergalust, PharmD, BCPS



Brittny Medenwald, PharmD

At 19 years old, my best friend was involved a motorcycle crash. Her severe TBI caused her to stay in the neurocritical care (NCC) unit for 13 days. That experience started my path toward practicing in NCC. It is our experience in neurocritical care that tells us that the mortality and morbidity of our patients does in fact rely upon the availability of mechanical ventilation.

Respiratory management and the use of protective ventilation in early phases of brain injury, such as TBI, ICH or strokes, is critical in preventing secondary hypoxia, hypotension and hypercapnia. Despite numerous clinical studies, the safest ventilatory setting has yet to be established in reducing the risk of ventilator-induced lung injury (VILI), impaired cerebral venous drainage, intracranial hypertension and increased ICP.

As a first-year pharmacy resident, I had a strong desire to be back in the NCC unit. I chose my rotations hoping to manage NCC patients. I was disheartened that despite rotating through various adult and pediatric critical care units, internal medicine and emergency medicine, I had scarce exposure to neurology. When comparing second-year residency programs, I desired a program that was dedicated specifically to neurology. Yet despite my continuous interest in this practice area, I was not aware that pharmacy had recently recognized it as a specialty. Luckily, I stumbled across a neurology residency program at Grady Health, and the rest is history.

Although the exact year neurology emerged as a specialty in the medical profession is not clearly defined, glimpses of neurology specialists began emerging in the 1800s. The American Neurological Association, established in 1875, was the first national neurological society in the world. During the next five decades, the designation of neurology as a medical specialty was not met with overwhelming enthusiasm, as attempts to branch from internal medicine and uncouple from psychiatry were difficult. Ultimately, the first formal training program in neurology originated at Harvard Medical School in 1935, and the field has continued developing and identifying subspecialties, including NCC.

Similar to medicine, neurology is challenged in pharmacy school curriculums with separating itself from psychiatry, as these topics are often combined into a “Central Nervous System” module, leaving students with limited exposure to neurology and much less exposure to NCC.

In contrast, the timeline of clinical pharmacy practice in neurology has not paralleled that of medical practice. The first formal training program in neurology pharmacy originated

Table 1: List of unique experiences.

Experience	Comments/Description
Foundation in neuroanatomy, neuro imaging and neurologic procedures	<ul style="list-style-type: none"> Enhanced understanding and effective communication with multidisciplinary providers regarding TCDs, EEGs, EMGs and advanced imaging as they relate to pharmacotherapeutic decision-making
Clinical scenarios and neurology literature	<ul style="list-style-type: none"> Assist with post-stroke anticoagulation timing Antiepileptic pharmacotherapy monitoring Anticoagulation reversal Dual antiplatelet therapy indication evaluation and monitoring Many more
Special neurology populations	<ul style="list-style-type: none"> Autoimmune diseases Brain death CNS infections Demyelinating diseases Geriatrics Movement disorders Neurointerventional Physical medicine and rehabilitation Palliative care
Administrative experience	<ul style="list-style-type: none"> Neurology medication use evaluations Neurology research Continuing education lectures Order-set design and creation Provider and nursing in-services

at the opposite side of the country, at the West Los Angeles VA Medical Center, in 2006. Neurology pharmacy received recognition as a unique specialty by the American Society of Health System Pharmacists (ASHP) last year — 83 years after the conception of clinical pharmacy and 30 years after cardiology and psychiatry emerged as unique specialties. Thus, it is not surprising that most NCC pharmacists complete residency training in critical care, emergency medicine or internal medicine specialty programs. However, with strict program standards, experiences in neurology/NCC are often limited.

With exponential increases in literature, complex medication regimens and barriers to medication access, it has become clear that dedicated neurology pharmacy residency programs are necessary to continue providing advanced care within the specialty and subspecialties. This need was noticed by both Dr. Sunita Dergalust and Dr. Katleen Chester.

Dr. Dergalust is credited with the vision and implementation of the first second-year neurology pharmacy residency program in the country and now offers two resident positions. The interest for the first neurology pharmacy residency program originated from pharmacy learners. Within the first four years after implementation in 2000, Dr. Dergalust's 6-week neurology rotation remained consistently scheduled with learners. Noticing and supporting this interest, Dr. Dergalust's pharmacy director provided funding for the first neurology pharmacy residency program in the United States.

Dr. Katleen Chester followed by creating the second, ASHP-accredited neurology residency program in 2017. This program is the first at a comprehensive stroke center (CSC) and level 1 trauma center. Her interest in providing dedicated training in neurology came from multiple sources of motivation, including challenges she faced while transitioning out of an ED practice environment into a neuroscience center. Despite training in a well-established CC program, she had limited, formal training in neurology/NCC, in part because the institution was not a CSC and had no NCC. Fortunately her training provided the skills necessary to establish clinical pharmacy services upon opening of a dedicated neuroscience center. Stepping into that new role was not without challenges, as Dr. Chester found that many of the clinical scenarios and medications common to the neuroscience center were not ones she had not been exposed to during pharmacy school or post-graduate training.

Dr. Chester was further challenged with holding hybrid or cross-coverage responsibilities between all levels of neurology patient care. This too is not a unique challenge, but one that many other clinical neurology pharmacists have expressed experiences. Many NCC positions incorporate varying degrees of responsibilities across the spectrum of neurology care. Thus, Dr. Chester found overwhelming support and collegial assistance from colleagues with experience surrounding similar challenges. She realized that dedicated, post-graduate training would create a new generation of neurology pharmacists who have been immersed in experiences highlighting the unique challenges and medications of this specialized population.

It was because of the insight from Dr. Dergalust and Dr. Chester that I was able to fulfil my dream of becoming trained in neurology pharmacy. My experience has shown me that practicing pharmacy in the NCC setting requires a completely different clinical skill set than I had developed on other rotations. Neurology medications are quite complex in their administration, mechanism of action and therapeutic drug monitoring. What's more, the timing of

Table 1: List of activities.

Responsibility	Benefits
Pharmacist-run clinics <ul style="list-style-type: none"> • Stroke • Refractory seizures • Movement disorders • Headache • Multiple sclerosis • Neuromuscular disorders • Peripheral neuropathy 	<ul style="list-style-type: none"> • Improved medication access • Increased clinic volumes by up to 24 patients per day • Patient education
Follow-up telephone encounters	<ul style="list-style-type: none"> • Patient education • Adverse effect monitoring • Medication adherence/ access evaluation
Telehealth	<ul style="list-style-type: none"> • Expands neurology care to rural areas surrounding Los Angeles • Brings care to patients who do not have access to specialists or primary care providers

medication initiation can have drastic effects in a patient with a neurologic injury. Having trained in this setting, I have had increased exposure to neurology literature and am comfortable reading, interpreting, and in most cases, extrapolating medication therapies from varying patient populations.

Training in neurology has provided me with a solid foundation of dedicated neurology skills that collectively, I may not have experienced in a single year in a different specialty program. A select list of unique experiences are included in Table 1. The combination of neurology/NCC experiences molds a different type of clinical pharmacist, bringing a distinct perspective to neurology patient care.

In addition to inpatient responsibilities, Dr. Dergalust and her residents use a multidisciplinary, team-based approach to address outpatient needs, even those beyond the clinic visit itself. A list of some of the activities described by Dr. Dergalust are included in Table 2.

With neurology as a recognized specialty, many colleges of pharmacy will likely expand curriculums to introduce students to neurology diseases. In addition, as more institutions incorporate NCC units, there will be a growing need for NCC pharmacists. This growth will likely lead to greater opportunities for students to take NCC rotations and increased interest in neurology pharmacy residency programs. ●

Opinion: Challenges with OPOs

By Wade Smith, MD, PhD, FNCS



Wade Smith, MD,
PhD, FNCS

I have practiced neurocritical care since 1994. As a fellow in 1993, I engaged in the first case of donation after cardiac death (DCD) in California. This experience, coupled with prior ethics consultation experience as a resident, initiated a career-long interest in organ donation. However, I have had several struggles with the organ procurement process throughout my career, and I am writing this article to ask if others have had similar or dissimilar experiences.

A few years ago, I was taking call for ethics when I was made aware of a young man on ECMO transferred from an outside hospital. Unfortunately, he died by brain death criteria and as a person who signed an organ donor card, the family was approached to explain that they would procure his organs.

His young wife was aware of her husband's desire to donate but had the following argument: "If his organs are taken, it might impair an autopsy determining why he arrested in the first place. Since he was found at work, I want to know if he was exposed to something. I want a full autopsy. I have two young children to raise without a father. If his employer caused his death, there could be financial compensation that will allow me to raise my family."

Designating yourself as an organ donor is done by signing a living will. Since it is considered a will, no person or entity can interfere with the process."

She was sleep deprived, and we suggested that she go home and that we address it the next day, but she refused to leave his bedside. The team was confronted by the visual of having her escorted from the ICU while he was taken to organ procurement. As an ethicist and a human being, I was supportive of the wife's request and the

patient did not donate. CMS was alerted by the Organ Procurement Organization (OPO) of my interference with the legal requirement to not interfere with this man's donation.

Designating yourself as an organ donor is done by signing a living will and is codified in the Anatomical Gift Act. Since it is considered a will, no person or entity can interfere with the process. Thinking about this, I am certain that the patient did not anticipate this scenario when he checked the box on his driver's license at the DMV. This is not informed consent in my opinion.

I have occasionally experienced coordinators completely alienating families and having that jeopardize the doctor-family relationship."

More commonly, I have experienced friction having OPO coordinators asking to be involved in DCD discussions with families. An experienced coordinator is essential to provide the details of donation in this circumstance and is an essential part of the consent process. But I have occasionally experienced coordinators completely alienating families and having that jeopardize the doctor-family relationship. At our institution, we require the OPO to first contact the ethics consultant on call to help initiate the process and help judge timing. I think this is an essential firewall to help advocate for patients and the organ donation system as whole.

Have you had difficulties with this process? Have you been asked to do something that makes you uncomfortable? Do you have examples that you can share with me? If you do, and/or if you have any comment about this, please email me at Wade.Smith@ucsf.edu. In particular, I am interested if your decision to be a registered organ donor has been influenced (positively or negatively) by your engagement locally in your organ donation process. ●

The Continuum of Consent

By Jamie Nicole LaBuzetta, MD, MSc, MPhil, UC San Diego, Department of Neurosciences, Division of Neurocritical Care



Jamie Nicole LaBuzetta, MD, MSc, MPhil

Because informed consent and informed refusal require decision-making capacity, a capacity assessment — even if informal and unstructured — is a necessary precursor to consenting a patient for diagnostic tests or treatment. A few years ago, I was taking call for ethics when I was made aware of a young man on ECMO transferred from an outside hospital. Unfortunately, he died by brain death criteria and as a person who signed an organ donor card, the family was approached

to explain that they would procure his organs.

Capacity has four elements:¹

1. Understanding the information delivered to them about proposed tests or treatment
2. Appreciation of how to apply this information in their specific situation
3. Reasoning (to make a choice)
4. Communication of a choice

Clues that a patient may be lacking capacity include decisions that are irrational or inconsistent with previously expressed goals.²

Sometimes, a patient clearly does not have capacity. However, assessing capacity can be complicated. In my experience, some misunderstandings regarding capacity exist even amongst experienced clinicians. These misunderstandings include:

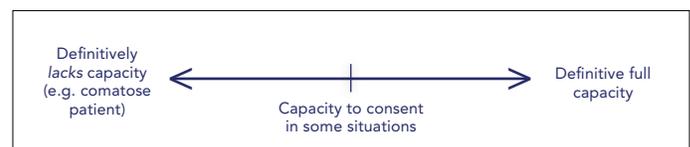
1. **Capacity (and consentability) are static.** All too often, I see patients labeled as “does not have capacity” with no plan to readdress. An individual who lacks capacity at time point No. 1 because of a reversible condition (eg, delirium, intoxication) may be consentable once the condition is appropriately treated or controlled. An assessment of capacity should be made at every patient encounter.
2. **Capacity is binary — all or none.** Capacity is task specific. This means that a capacity assessment must be made for each medical decision; does the patient have capacity to make a specific decision? A patient may have the capacity for one type of medical decision but not another.
3. **Equating “alert and oriented” with having capacity.** I have witnessed many a trainee attempt to consent a patient who lacks decision-making capacity, and justifying that attempt by saying that the patient was alert and oriented. On the other hand, I have witnessed physicians attempting to consent a surrogate for a patient who is capable of making certain decisions themselves. Indeed, a patient may only be oriented to himself and still evidence the necessary components of a capacity assessment and consentability for specific decisions. Equally, a patient may be fully oriented and be unable to understand (or communicate) the information presented to them, thus lacking capacity to make some medical decisions.

4. **A formal psychiatry consult is required to assess capacity.** Informal, unstructured assessments of capacity are often difficult, with low inter-rater reliability.³ There certainly are instruments designed to evaluate medical decision-making, but there is no gold standard. A recent review notes that the inclusion of an MMSE or MOCA can be helpful in guiding the capacity assessment, but are not synonymous with the capacity assessment.³ The assessment can be performed by any clinician who will obtain informed consent and must be guided by the consideration of the four components (understanding, appreciation, reasoning, communication).

I like to think of consentability as a continuum from definitively lacking capacity (and therefore not consentable) to definitively capable of consenting (see Figure 1).

Refusal of medical care denotes neither incompetence nor lack of capacity. Capacity influences the right to determine what happens to one’s own body, even if refusal of medical care may result in injury or death. In the absence of healthcare consent capacity, the principle of autonomy transitions to a surrogate decision-maker. In circumstances of refusal of medical care, the physician has a duty to inform the decision-maker about the potential risks of their refusal.

Figure 1: Capacity as a continuum.



Lack of capacity is not an appropriate reason to exclude them from the information process. For instance, if a patient lacks capacity, and a surrogate decision-maker consents to arterial catheterization, the patient’s assent (or at least lack of active dissent) for that procedure is still desired; thus, sharing information with the patient about clinical activities is to everyone’s benefit. ●

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COVID-19 and the Rise of International Medical Cooperation via the Digital Highway

By Peter J. Papadakos, MD, FCCM, FAARC, FCCP



Peter J. Papadakos, MD, FCCM, FAARC, FCCP

As an individual who studies the effect of technology on the practice of medicine, one of the most amazing aspects of this terrible pandemic is how the medical community around the world has joined together as one to share protocols, guidelines and disaster plans with each other. I have a broad network of colleagues in both trauma critical care and neurocritical care, and it's been outstanding how rapidly we all joined

together via e-mail, WhatsApp forums, Zoom conferences and others to share our patient care experiences.

We circle the globe from every U.S. state, Canada, South America, China, Japan Korea, Italy, Spain and others. I've been able to share this international information almost hourly with my own critical care team and my personal contacts to get the latest medical information out to aid the care of our patients. It is fantastic to get advice of international leaders and societies on some of the basics in the care of such COVID-infected patients. It frees us from having to develop guidelines for our own unit or facility and be able to focus on patient care.

It is wonderful to get ideas on how to best preserve PPD equipment that I never knew could be reused using operating room sterilization and UV technology. Colleagues shared how local clothing industry, local tailors, sewing circles and handcrafters could be martialled to create surgical masks and gowns by working at home. I am old enough to remember when I started in surgery that gowns and masks were made of cloth and recycled within our own hospital. Maybe this is a lesson to all of us that disposable items can be easily displaced. In my own community, Hickey Freeman, a luxury clothes maker, has put its business online and had employees work from home to create both gowns and masks. This may be a key contribution to our area hospitals. We should mobilize local resources and volunteers to spread this grassroots model to every city and town to support the effort to get PPD supplies to healthcare providers. Local brewers and distilleries have repurposed to make hand sanitizers to replace their local business.

Another key aspect from this digital idea sharing is models in staffing and logistics. The key message is that this COVID challenge requires a deep reorganization of our work and staffing models, as they are practiced now. We do not wish to let administrators think they can run business as usual. In few days, we may all be dealing with a COVID surge. This is not just an ICU problem; it is a hospital-wide and system problem. All over the world, elective surgery has been stopped prior to even the first inflow of COVID patients — preparation has become proactive versus reactive. Hospitals in Toronto have run simulations and developed a surge plan — why

not copy and repurpose them to fit your local needs? They will shut down the ORs and move as many patients as possible from general wards. Some health systems have developed plans to use ambulatory surgery centers as patient overflow areas if the hospitals are overwhelmed with patients to decompress their wards. Anesthesia machines and anesthesia providers may reinforce ICUs to care for patients in respiratory failure several ratio models as to intensivist to anesthesia provider have been put forward. One model has one intensivist supervising 10 anesthesia providers. This may put more ICU beds on line more rapidly than building new health facilities.

"How do I staff my ICU with providers?" is another question being discussed on almost an hourly basis. The key takeaway is the ability to preserve as much staff as possible for the surge. As the number of COVID-infected individuals in the community raises, it raises the chance staff members may become sick. This has been reported throughout the world.

Departments need to have plans in place to have blocks of staff in reserve. In other words, have two-thirds of your critical staff at home and away from hospital patients, so they can replace staff as they become ill and fatigued. Cut down on rounding teams, use non-ICU providers, such as surgeons, to gain vascular access, anesthesiology staff to do all hospital intubations and post-operative nurses to reinforce ICU nurses.

Many facilities have developed dedicated anesthesia teams that are responsible to intubate every patient using high level PPD protection. As we have learned from Asia and Europe, one of the most common times of contamination of ICU staff is during intubation. The common axiom of "the more you do something, the better you get" comes into play by using dedicated senior level providers. Consultants can also be utilized from home via Zoom and other video conference platforms. One city stopped its competitive model and began sharing consultants via electronic means across the network borders. Draw on each other's strengths as an example. There may be a world famous expert on ARDs management in the hospital down the street, and your community may be better served if that individual can aid in complex ventilator care of 200 patients and not the 12 in their home ICU. This can also be expanded across an entire state or even a county. Each hospital and community can develop its own plan to modulate its staff based on local resources and means.

Lessons can be learned if we are able to share and use the lessons learned from others who were the first to battle the COVID pandemic. This may be a model that we can use for the next pandemic, so we're better able to respond. Lessons learned now may save millions later. The internet has never been so useful to healthcare providers as it is today.

Thank you to all the healthcare workers around the globe who are sharing their experience and knowledge to us all. ●

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Intra-Arterial Selective Cooling in Acute Systemic Stroke

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“LEVI comprises cooled saline infusion through the same access obtained for thrombectomy, with the goal of causing local hypothermia at the site of injury.”

Thrombectomy and Cooling

Thrombectomy and thrombolysis have proven effective in the treatment of stroke; however, strides remain to be made to promote tistular reperfusion itself. Various methods of neuroprotection have been posed as a possible strategies to minimize stroke burden in conjunction with recanalization. One of the proposed methods has been therapeutic hypothermia. Whole-body cooling has been studied extensively, showing promise in preclinical studies, as well as proven feasible. However, an outsized impact on outcomes remains to be found, most recently noted on the multicenter, randomized EUROHYP-1 trial.

Additionally, whole-body cooling has several drawbacks, including shivering and elevated intracranial pressure, which may necessitate additional sedation, increased risk of pneumonia, and electrolyte and metabolic derangements. Furthermore, whole-body cooling is slower to reach goal temperature, as compared to a local infusion that can cool tissue in less than 10 minutes. Given metabolic derangements and secondary stroke damage have been shown to be time-sensitive, a more rapid onset technique could prove advantageous. Thus, targeted cooling may prove more effective without the side effects and treatment complexity associated with whole-body cooling.

“Targeted cooling may prove more effective without the side effects and treatment complexity associated with whole-body cooling.”

Intra-Arterial Selective Cooling

A proposed method for more targeted therapy is intra-arterial cooling or Local Endovascular Infusion (LEVI). LEVI comprises cooled saline infusion through the same access obtained for thrombectomy, with the goal of causing local hypothermia at the site of ischemic injury. The procedure can be performed prior to recanalization, after or both.

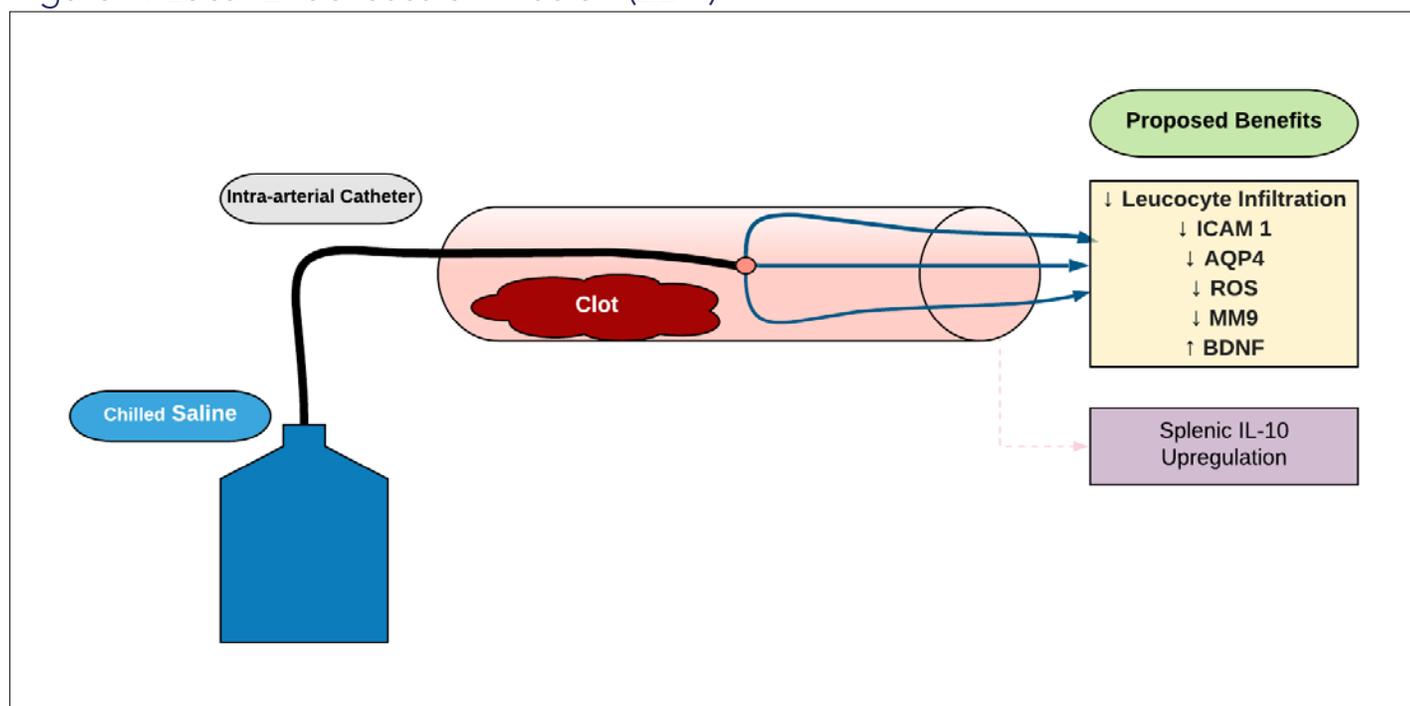
Proposed Mechanisms of Action of Selective Cooling

LEVI has shown promise in both animal models and patients, with various theorized mechanisms, such as washout of deleterious metabolites, inhibition of cortical spreading depolarizations and various effects on local inflammation. This technique may decrease intracellular adhesion molecule-1 expression, thus limiting leukocyte infiltration and possibly decreasing the production of reactive oxygen species and pro-inflammatory cytokines. Animal studies have shown upregulation of brain-derived neurotrophic factor and splenic interleukin 10, which may be immunomodulatory in this case. LEVI may also aid in preserving blood-brain barrier integrity by decreasing matrix metalloproteinase 9 and aquaporin-4 expression thus decreasing local edema. It is also postulated that metabolites, such as lactate, carbon dioxide and prostaglandins, are responsible for deleterious vasodilation once reperfusion is achieved and that washout of these moieties may decrease reperfusion injury. This effect was also observed with warm saline infusion, further suggesting plain irrigation may be of benefit.

Current Studies and Techniques

In one study enrolling 113 participants, 45 of which underwent short-duration intra-arterial selective cooling infusion. Once the clot was traversed with the microcatheter, an infusion of 10ml/

Figure 1: Local Endovascular Infusion (LEVI).



min 0.9% saline at 4°C was applied for five minutes. Following thrombectomy, the infusion rate was increased to 30ml/min and continued for an additional 10 minutes. A statistically significant decrease in final infarct volume averaging 19.1ml was observed in the intervention arm; however, there was no significant difference in 90-day outcomes or return to independence. In the end, it was concluded that LEVI was both clinically feasible and safe.

Future Directions

Overall, there seems to be compelling evidence that intra-arterial cooling prior to and possibly after recanalization is safe and poses little logistical challenge in execution, as well as decreasing final injury volume. LEVI also appears to be a promising avenue for trials involving other neuroprotectants via the same route as the cooled saline. Magnesium sulfate, albumin, erythropoietin and NMDA receptor antagonists have been trialed in this fashion, significantly reducing the infarct volumes in preclinical studies. ●

Note: The authors have no actual or potential conflict of interest in relation to the topics discussed in this column. This article may discuss non-FDA approved devices and "off-label" uses. NCS and Currents do not endorse any particular device.

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