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Education

in Neurosurgery



Congress of
Neurological
Surgeons

8 Online Education:
Where Content
Meets Convenience

14 The Changing Role
of CME

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**Congress of
Neurological
Surgeons**

EDITOR'S NOTE



Martina Stippler, MD
2018 Editor,
Congress Quarterly

“Develop a passion for learning. If you do, you will never cease to grow.” This quote by American author, Anthony J. D’Angelo is the mantra and advice we want to teach our children, instill in our residents and mentees, and choose to live by ourselves. Neurosurgeons, more than any other specialty, know what a lifelong commitment to excellence is, and it cannot be achieved or maintained without lifelong learning. This is also the mission of the Congress of Neurological Surgeons. *The CNS exists to enhance health and improve lives through the advancement of neurosurgical education and scientific exchange.* Hence, the topic of this issue — Education — has grown organically from principles our CNS volunteers and membership live every day: teach, learn, educate.

In his president’s message, Dr. Rao, the president of the CNS, talks about the challenges of too much information and how it affects medicine and resident training. It is my great pleasure to introduce you to the CNS Education Division and their work in this issue of the *Q*. They truly make the vision of the CNS — *to be the premier educational organization in neurological surgery* — come true. CNS has many online education offerings and the role of online education these days is discussed knowledgeably by Dr. Barkhoudarian.

Dr. Axelsson, a neurosurgeon who also holds a degree in medical education, shares with us the future of medical education and how it will shape medical school and the medical students who will become our residents. Dr. Girgis discusses whether the concept of the flipped classroom can be applied to neurosurgery.

One of my favorite articles in this issue is the one by Professor Rima Rudd and her post doc Anna Miller from the Harvard T. H. Chan School of Public Health discussing how we can educate our patients and improve health literacy.

You will find many more interesting articles in this issue on burnout in resident training, the future of CME and the recent changes the ABNS made to the MOC requirements.

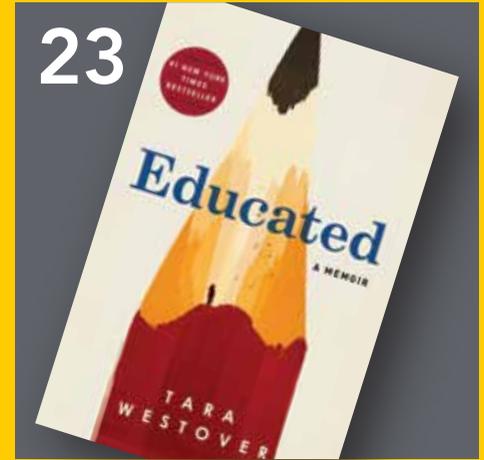
I want to conclude with a quote by author Tara Westover, whose book, *Educated*, was named one of the best 10 books of 2018 by *The New York Times*:

“The decisions I made after that moment were not the ones she would have made. They were the choices of a changed person, a new self. You could call this selfhood many things. Transformation. Metamorphosis. Falsity. Betrayal. I call it an education.”



Thank you to the 2019 CNS Executive Committee for a great start to the year. Keep an eye out for exciting new educational programs and courses being developed by this amazing team.

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PRESIDENT'S MESSAGE



Ganesh Rao, MD
President, Congress of
Neurological Surgeons



Neurosurgical Education in the modern era: The evolution of medical education

Medical education in the U.S. at the turn of the 20th century was in disarray with wide variability in the quality of instruction, standardization of curriculum, and requirements for admission and graduation. At the time there were 155 medical schools for a U.S. population of approximately 75 million people. Contrast that with 141 MD and 30 DO schools today when the U.S. population approaches 330 million. Medical schools in the year 1900 had virtually no oversight, and training in all but a handful was poor. Over 100 years ago, Abraham Flexner was commissioned by the Carnegie Foundation to assess the state of medical education in the United States¹. The report was issued in 1910 and has had profound effects on medical education that reverberate to this day.

Today, medical education is again in a state of significant upheaval. Medical schools are shifting away from a four year curriculum that traditionally involved basic science coursework in the first two years, to more practical, clinically-relevant education and early exposure to the outpatient and inpatient settings. Technology has played a prominent role in this transition. High quality courses are available online and there is almost no need to sit in a classroom. These changes allow students to learn at their own pace. Simulation and virtual reality are now supplanting traditional cadaveric dissections for learning anatomy. Laparoscopy simulators have allowed general surgery residents to become technically proficient before they touch a patient. Simulation has also taken hold in neurosurgery,



permitting the practice of procedures on a virtual patient. It is now possible to coil an aneurysm or deploy a stent on a simulator that mimics real human anatomy. Three dimensional modeling and augmented reality are enabling surgeons to perform a practice run of a procedure before they do so on a patient. Robots are now guiding pedicle screw placement and the implantation of electrodes for seizure mapping. These technologies are certain to improve training for our students and residents and will no doubt improve outcomes for our patients.

An explosion of medical literature

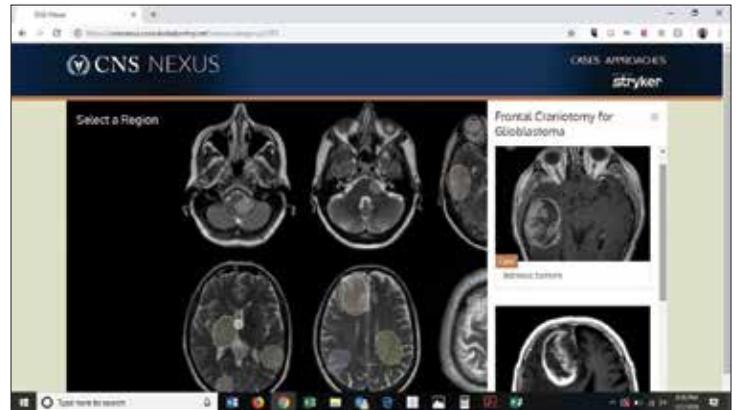
The amount of instructional information available to individuals at all levels of medical training is staggering. By some estimates more than 2.5 million scientific publications are generated every year. Thomson Reuters indexes over 18,000 scholarly and technical journals with 108 million citations. Treatments and the indications for their use can change quickly in the present environment. Sometimes this can have deleterious effects; keeping current requires an almost impossible attention to the literature. Aaron Carroll, a professor of pediatrics at Indiana University, has noted that it is hard for physicians to adapt to new evidence. As an example, he cites well-performed research showing that tight glycemic control in critically ill patients results in a significantly higher rate of death compared to traditional, less stringent, glucose control². However, these results were in contrast to previously published studies that had been accepted as dogma and, as a result, many ICUs still adhere to tight glucose control in critically ill patients. Unlearning a practice that has been ingrained is hard to do. The reasons are multifactorial but include difficulty keeping up with the vast amount of medical literature as well as being able to critically analyze how well a study was performed.

We rely on medical journals to publish well conducted studies after

peer review. Still, it is incumbent upon the reader to critically analyze the methodology, results and conclusions of a study. As physicians we are probably better equipped than most to determine the quality of a study, but it remains a challenge. Sure, we all know that $p < 0.05$ is statistically significant, but how many of us know if the appropriate statistical test was performed, or if a sample size was powered appropriately, or if the appropriate controls were employed? The difficulty in determining the validity of a study is compounded by the vast number of studies being produced. We have ways to determine the importance of a published study, including the reputation of the authors and the journal publishing the work (often measured by the much maligned impact factor) but this hardly insulates us from poorly conducted research. Perhaps the most infamous example of this is the work published in *The Lancet* by Andrew Wakefield in 2004. Wakefield's study of just 12 children linked the measles, mumps and rubella vaccine to a "pervasive developmental disorder" and was a catalyst for the anti-vaccination movement. The article has since been disavowed by *The Lancet* who indicated in the notice of retraction that there were "several elements of the paper" that were "incorrect and contrary to the findings of an earlier investigation". Nevertheless, Wakefield continues to defend the study and remains an anti-vaccination activist. Measles outbreaks are now more common, particularly in areas of decreased vaccination rates. This is the price of poorly conducted peer-review. The rise of predatory journals has also become a significant problem in recent years. These journals, which often charge a significant sum for publication, have taken advantage of the current publish or perish era, when one's h-index³ is used as a metric for career advancement. Because many are "open access" they are available to the public who may not have the understanding that some of these journals do not always employ rigorous peer review.

The democratization of information undermines expertise

The internet has given our patients nearly unlimited access to medical studies. At face value, the democratization of information may appear to be a good thing. However, our patients' ability to parse good studies from bad is limited. We have all had patients show up in our office, web page in hand, asking about the latest herb, vitamin or cannabinoid oil to treat their condition. For the less informed, the internet can be hazardous to your health, full of unsubstantiated claims and spurious data. With the internet, anyone can appear to be an expert and every false expert undermines the trust in, and effectiveness of actual medical expertise. This devaluation of expertise threatens public health. Our years of experience with effective treatments are doubted because a sleek website with questionable content can be built and published overnight. The negative effect of ignoring well-established medical care is exemplified by the treatment Steve Jobs sought after being diagnosed with pancreatic islet cell neuroendocrine tumor. It is well known that Jobs initially used alternative medical treatments for his condition, though his tumor was potentially curable with surgery, Jobs delayed definitive surgical treatment, which may have led to an early demise.



NEXUS, CNS' online case repository, was designed to allow residents and surgeons to quickly review a case like their own before going into the OR.

The future of medical education

We neurosurgeons and our patients have benefitted greatly from advances in technology. The internet has given our neurosurgical residents the ability to prepare for procedures by referring to online content that includes vivid intraoperative photographs and interactive videos⁴. Our residents have virtually all medical knowledge in the palm of their hands. There is arguably no reason not to know an answer to a medical question within seconds. And yet the internet can also be the source of significant confusion for our patients and trainees. Our own specialty is susceptible to the misinformation that is widely available to the public. Unproven technologies for the treatment of back pain and useless (and sometimes dangerous) treatments for cancer are becoming more commonplace. For our residents, equipping them with the ability to critically evaluate the medical literature in an ongoing fashion will help to insulate them and their patients from potentially harmful treatments. Fortunately for neurosurgery, lifelong learning is in our DNA. Over 100 years ago, the Flexner report resulted in a seismic shift in medical education by creating education standards for medical schools. We must again adjust medical training and our own practices to the significant changes that modern technology has wrought. ❏

References

- 1 Flexner is a controversial figure. He advocated for closing all but two African American Medical Schools. This legacy has negatively impacted health care for African Americans ever since.
- 2 <https://www.nytimes.com/2018/09/10/upshot/its-hard-for-doctors-to-unlearn-things-thats-costly-for-all-of-us.html>
- 3 The h-index is defined as: h published papers each of which has been cited in other papers at least h times
- 4 The CNS' NEXUS is an excellent example. Available for free at www.cns.org/nexus.

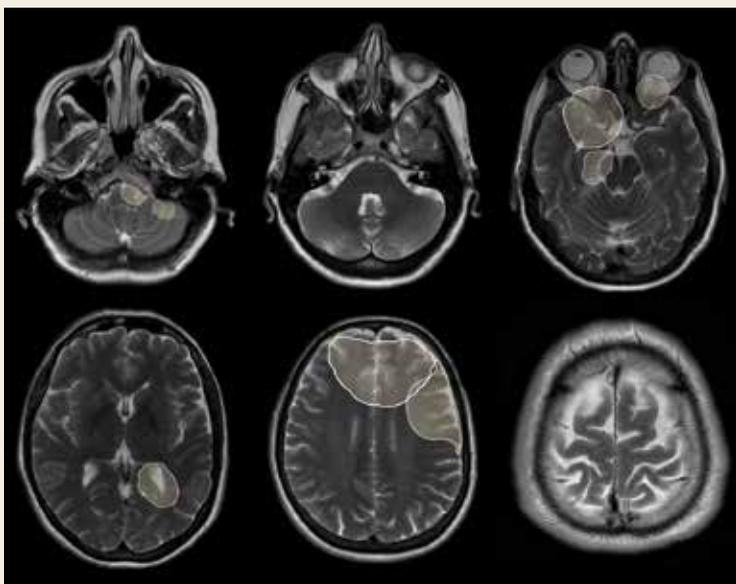


Ashok R. Asthagiri, MD



Nick Bambakidis, MD

The CNS Education Division: Driven by Innovation, Powered by Neurosurgeons



For more than 65 years, the Congress of Neurological Surgeons has worked to provide our members with the best neurosurgical training and educational products to improve health around the world. Today, the CNS Education Division and its related committees and workgroups are powered by more than 90 volunteer neurosurgeons working year-round to deliver the most relevant and cutting-edge educational content to help surgeons expand their knowledge and skills in this rapidly advancing specialty.

Live Courses

In 2019, the CNS is coming to your doorstep, holding regional courses on topics relevant to your practice, from the popular Spine Complications Course in Park City, Utah to the new Minimally Invasive Cranial Course in San Diego, California—both offered this month. The MIC Course represents CNS' commitment to understanding and addressing the evolving needs of our membership. As the minimally invasive spine and endovascular neurosurgery movements transition to mainstream, our team has developed this new hands-on course to educate neurosurgeons on novel technology that is set to influence our academic and community practices alike.

The Acute Stroke Care Course, being held this spring in Chicago represents CNS' intent to become more engaged at the community level, thanks to nationally recognized faculty leadership who are bringing the CNS culture of education to not only local neurosurgeons, but also EMT, nurses, and Advanced Care Practitioners.

While expanding the footprint of educational offerings, the CNS continues to strengthen the core educational concepts of translating human anatomy into practice with cadaveric skull base workshops as well as self-assessment, critical analysis and professional collaboration to overcome complications and challenges in spinal and tumor surgery that even the most competent neurosurgeon faces.

The CNS has embraced the concept of life-long learning and is developing a comprehensive array of educational products to assist neurosurgeons at all points during their career. From teaching basic principles of rounding on patients and medical student engagement to transitioning to retirement, the CNS is devoted to providing our entire membership with education that addresses the varying concerns of neurosurgeons at different times during their career. After performing an extensive review of the educational needs of a neurosurgeon through their career, a notable deficiency in the transition to practice was recognized. This has led to the development of a new Transitions to Practice Course and indications curriculum, intended to address case selection and highlighting practical issues of transitioning from residency to practice. The inaugural course will be held in August 2019 in Chicago.

— See page 6 for a complete listing of upcoming courses —

Online Learning

The CNS has long recognized that the challenges of modern neurosurgical practice make it difficult for members to attend every educational course and conference. For the past decade, the Education Division has poured significant resources into online learning formats that are adaptive to your practice and accessible on your own schedule. Today our online portfolio includes more than 170 offerings and more than 250 hours of CME.

The CNS Education Division annually produces over 20 live webinars, on topics such as Guidelines for the Management of Severe Traumatic Brain Injury, Image Guided and Robotic Spine Surgery: State

VOLUNTEER SPOTLIGHT

VOLUNTEER PROFILE:

Maryam Rahman, MD

CNS Volunteer since 2014



Dr. Rahman started her service as a committee member on the CNS Case of the Month. She has also served as a junior faculty member for the CNS Leadership in Healthcare Course

for the past two years. Today Dr. Rahman is the chair of the Case of the Month Committee and the Managing Editor for NEXUS and is especially excited about seeing NEXUS develop into a rich resource of operative cases for neurosurgeons to use for free from any online platform.

"Being involved in the CNS has been extremely rewarding. The work is different than what we usually do seeing patients and being in the OR and most of what I do in the CNS has been new to me. The work has inspired me to learn more about leadership and management and taking part in the CNS Leadership in Healthcare course was a big part of this. I would encourage young neurosurgeons to volunteer for the CNS as it will help develop a different skill set and most importantly, connects you with other motivated neurosurgeons who will likely be your friends for life."

VOLUNTEER PROFILE:

Kristin Huntoon, MD

CNS Volunteer since 2014



Dr. Huntoon actually started her service with CNS while in medical school, serving as a Sergeant at Arms at the Annual Meeting, and then became a CNS Resident Fellow in

2014. Today she is a valued member of the SANS committee, helping to edit educational material and format boards-style Q-bank questions. The SANS Committee meets a few times a year to review the questions and Dr. Huntoon helps critique questions written by other members of the committee. She looks forward to reconnecting with the members of the committee this year, as well as welcoming and working with the new members.

"Volunteering with CNS has been a really rewarding experience - the other members of the committee treat me as a peer, despite me still being a resident, and I get a great response to my ideas, questions, and suggestions. Editing the materials and formatting board-style questions has been a powerful adjunct to my own learning as I move into my final years of training. It's also been great to witness firsthand the role of the committee in CNS and the goals that the organization has for assisting its members and promoting leadership. Connecting with senior members of the committee has been invaluable for me in helping to plan my own career and next steps in neurosurgery and in CNS."

VOLUNTEER PROFILE:

Daniel Hoh, MD

CNS Volunteer since 2010



Dr. Hoh began his CNS volunteer service as a resident nearly 10 years ago, writing questions for SANS. Over the course of his tenure, he has served as a junior faculty member for

the the CNS Resident Simulation Course, a member of the CNS Education Division Online Editorial Review Board and more recently on the NEXUS Editorial Board and the 2018 Annual Meeting Scientific Program Committee.

Today, Dr. Hoh is a Member at Large on the CNS Executive Committee and recently became the SANS Chief Editor, taking over for Dr. Garni Barkhoudarian. In this role, he hopes to continue to expand the scope of SANS as a lifelong learning tool for neurosurgeons and promises that CNS members will soon see SANS modules on additional relevant topics for both residents and practicing neurosurgeons.

"Volunteering on a CNS committee is an excellent way to meet new mentors, develop team skills, and make lasting relationships with colleagues around the country. In particular, the staff at CNS headquarters is a wonderful, tireless group who are always eager to work with enthusiastic volunteers. In the end, it is also a lot of fun to be part of a dedicated team that shares the same goal of neurosurgery education."



Faculty and attendees discuss indications during a case review at the CNS Oral Board Review Course.

of the Art, and Transclival/Transodontoid Approaches. Our essential oral and written board review series are also updated annually and offered live just prior to each exam. Plus all live webinars are retained as on-demand offerings, with a catalog totaling more than 150 courses available at your convenience. And new in 2019, the CNS is offering a new Recognition for Participation in Neurosurgical Education program exclusively for our international members, which allows participants to earn points for online courses completed and print a special certificate upon completion of 20, 40 or 60 hours of content.

SANS, CNS' self-assessment in neurological surgery has certainly stood the test of time as a trusted resource for practice improvement and CME. But even this time-honored product has gotten a modern face lift thanks to the tireless work of the SANS Editorial Board, led by Chair Garni Barkhoudarian and Vice Chair Martina Stippler. Today, in addition to the three classic SANS exams, members can choose from nine different SANS modules—including seven subspecialty modules, the non-clinical SANS Competencies module and the new SANS Indications, which was designed to improve diagnostic decision making, helping surgeons as they enter practice and prepare for the ABNS Oral Examination. A bundle of all seven subspecialty modules is also offered for individual subscription or for institutional license. Together, these products offer tremendous value for practicing surgeons and residents alike.

NEXUS, the latest addition to CNS' online education arsenal has also grown tremendously in the past year, under the leadership of Editorial Board co-Chair Peter Nakaji and Managing Editor Maryam Rahman. NEXUS is a comprehensive case-based repository of neurosurgical operative techniques and approaches that was designed to allow surgeons to quickly review a case like their own before heading into the operating room. Through the work of the editorial

Upcoming CNS Courses

CNS Oral Boards Review Course
 February 23–24, 2019 | Houston, Texas
 October 19–20, 2019 | San Francisco, California

CNS Leadership in Healthcare Course
 May 10–11, 2019 | Rosemont, Illinois

CNS Vanguard Leadership Course in Healthcare
 May 10–11, 2019 | Rosemont, Illinois

CNS Acute Stroke Care Symposium
 May 17, 2019 | Chicago, Illinois

Transition to Practice Course
 August 10–11, 2019, Rosemont, IL

CNS Skull Base Fellows Course
 August 29–30, 2019 | Cleveland, Ohio

2019 CNS Annual Meeting
 October 19–23, 2019 | San Francisco, California

Tumor Complications Course
 January 24–26, 2020 Las Vegas, NV

Spine Complications Courses
 February 2020

2019 Jointly Provided Courses

North American Neuromodulation Society (NANS) Annual Meeting
 January 17–20, 2019 | Las Vegas

Joint Section on Pain 2019 Biennial Meeting
 March 13–14, 2019 | Miami Beach, Florida

Expanding your Toolbox
 Spine Summit 2019
 March 14–17, 2019 | Miami Beach, Florida

board, NEXUS now features 400 cases across neurosurgical subspecialties—each designed to efficiently highlight the approach and alternatives, walk through the procedure step-by-step and address the outcomes, pearls and pitfalls. Cases are highlighted by outstanding medial illustrations, operative images and video and organized in a visually compelling and intuitive navigation. And to optimize the utilization and value of this flagship product, NEXUS is available free to all CNS Members and is now open for submissions. 

CNS Education in Your Pocket

Beyond our extensive catalog of live and online courses, the CNS Education Division has developed a host of apps and podcasts that allow you to bring the power of our educational content wherever you go.

Neurosurgery Survival Guide (NSG)

Created by neurosurgeons, for neurosurgeons, the NSG is a quick reference, high-yield guide that encompasses the massive breadth of knowledge and information needed when caring for neurosurgery patient

- iOS <http://itunes.apple.com/us/app/neurosurgery-survival-guide/id432545124?mt=8>
- Android https://market.android.com/details?id=com.nsg.app&feature=search_result

SANS Boards

This handy study tool offers 200 questions on critical information covered on the ABNS Primary Examination.

- iOS <https://itunes.apple.com/us/app/sans-boards/id624657132?ls=1&mt=8>

CNS Guidelines App

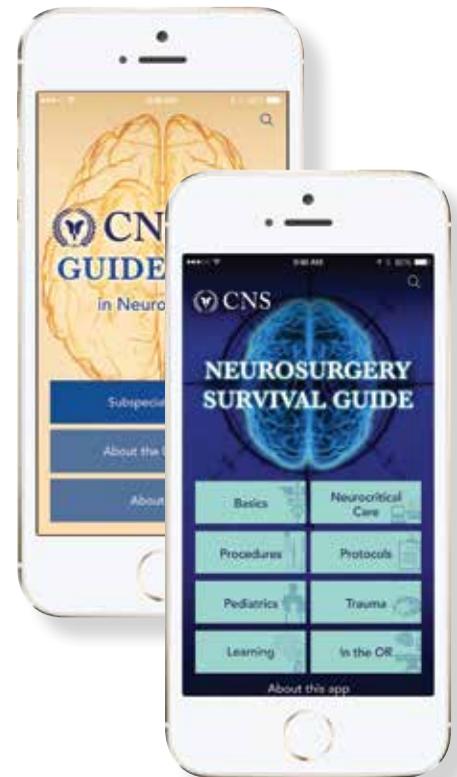
Get immediate, at-the-point-of-care access to guideline recommendations and topic overviews, along with links to full text, for all CNS-produced evidence-based clinical practice guidelines.

- iOS <https://itunes.apple.com/us/app/cns-guidelines/id1292857962?mt=8>
- Android <https://play.google.com/store/apps/details?id=com.cns.app&hl=en>

CNS Journal Club Podcast

The CNS Journal Club podcast presents essential journal articles in a classic journal club format with conversations by the authors and other neurospecialists.

- iTunes <https://itunes.apple.com/us/podcast/cns-journal-club/id1279506968?mt=2>
- SoundCloud <http://soundcloud.com/cnsneurosurgeon>



NEW THIS MONTH

Be sure to check out these great CNS Education offerings updated every month.

Case of the Month

COTM serves as forum for discourse regarding the management and treatment of ordinary and extraordinary cases. Choose what you believe should be the standard of care. Respond anonymously, check your answers, and read up on the rationale.

www.cns.org/education/browse-type/case-month

Neurosurgery Watch

Each month, our panel identifies and summarizes key points of selected significant papers from over 50 journals. We emphasize the most significant findings that potentially change clinical management or treatment of neurological diseases.

www.cns.org/news-advocacy/neurosurgery-watch

CNS Spotlight

Each month one key Neurosurgery article is the launch point for a self-guided journey of discovery. Readers get easy access to related content from CNS and NEUROSURGERY® Publications on the CNS Spotlight gallery.

www.cns.org/spotlight



Garni Barkhoudarian

Online Education: Where Content Meets Convenience

Medical education has transformed significantly since the days of Vesalius and amphitheater dissections. As modern medicine has advanced through technological innovations, so have the educational tools available to medical students, residents and practicing physicians. A major component of these resources is online education content. These are now commonplace, including digital textbooks and journals, webinars, online examinations, demonstrative videos, and simulation modules.

Access to online education has blossomed over the past decade, with increasingly more organizations and institutions providing content and resources, many with free access. As such, there has been a shift of medical education outside the classroom and into the living room. This has been received positively by students and practitioners and is quite appealing to the incoming generation of neurosurgical residents and young surgeons. Currently, many medical schools offer nearly their entire didactic curriculum as online content. Similarly, continuing medical education requirements can be easily fulfilled via online webinars and examinations.

The question remains as to the efficacy of these online resources. Are they able to educate the student or practitioner with the same impact as traditional in-person didactic lectures and examinations? In short, does online education work? What is its role with surgical education in the neurosurgical community?

There is little doubt that specific aspects of neurosurgical education must be taught in person—such as surgical technique,

physical examination, bedside manner and patient/family interactions. Many would argue that the only setting to learn surgery is in the operating room. However, cadaveric dissections, surgical simulation modules, virtual modules and operative videos have augmented the education of operative techniques while simultaneously providing access to those without exposure to experienced surgeons for tutelage.

The increased utilization of online educational resources is due to a multitude of factors including regional access, relative cost for educational value, available time for residents and physicians, preparation for examinations (written and oral boards), and continuing medical education requirements by state licensing authorities and profession-specific requirements (e.g., pain management or radiology). The quality of education provided is difficult to measure and is inferred via student comments and feedback, board examination scores, practice metrics, and content popularity (repeat or referred users). Babu et al. noted cost and time away from practice to be significant factors in surgeons' decision of CME option.¹

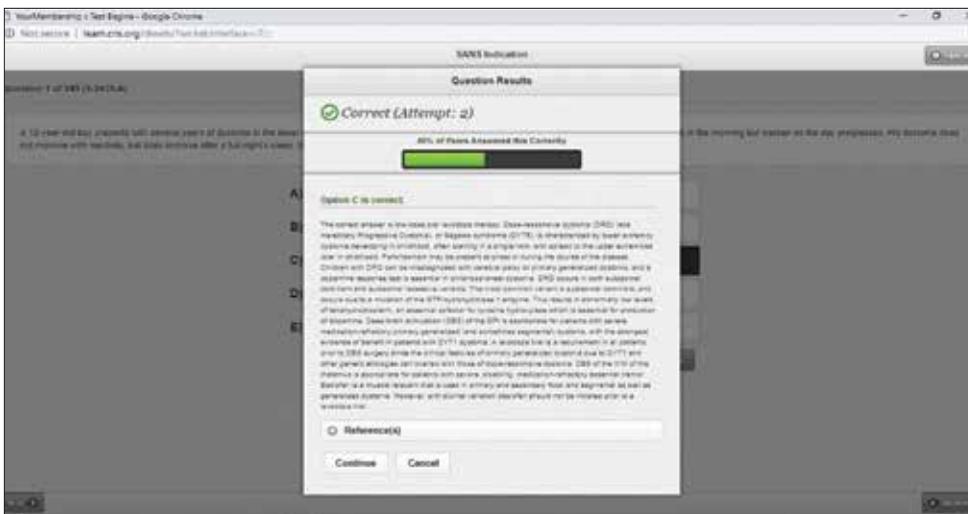
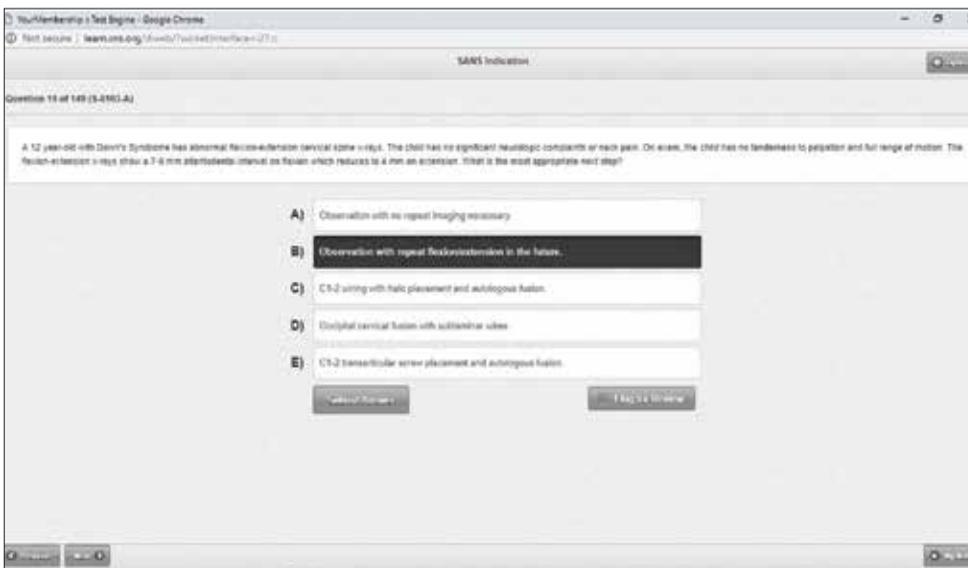
Much of the educational research to evaluate online or digital education impact relies on survey-based data; either from attendees or educators. A key distinction is between synchronous (real-time; e.g., live webinar) and asynchronous (post-hoc; e.g., recorded lectures or self-assessment examinations) online resources. Synchronous online resources have more impact when there is a high-quality capability of user interaction with the faculty. Asynchronous resources have increased usability given

instant availability and the ability to complete the tasks in installments.

A recent sponsored survey noted that 84% of physicians would prefer to complete their CME online, preferably using a video-on-demand system.² An Australian meta-analysis looked at the efficacy of online CME for general practitioners and found 73% noted improvement in satisfaction, knowledge, or practice changes.³ Patient outcomes were unable to be assessed, but they noted that the value of online resources is dependent on the following: student motivation, content quality, and online medium usability.

Not surprisingly, there is no lack of resources of online educational resources for neurosurgical education. The Congress of Neurological Surgeons offers a diverse and recently expanded array of online educational products addressing needs for medical students and residents; young attendings transitioning into practice and seasoned practitioners looking to advance their knowledge or fulfill CME requirements. These range from synchronous products such as the Live Webinar series to asynchronous products including recorded lectures, narrated Powerpoint lectures, CNS NEXUS, CNS Spotlight (comprehensive journal article review) and self-assessment examinations (SANS).

These online resources have been consistently popular for neurosurgeons seeking to obtain CME credits and for residents and fellows preparing for their operations, rotations and board examinations. Some live webinars have been validated with pre- and post-seminar tests with generally positive benefits. Though it is difficult to verify the impact of



Introduced in 2018, SANS Indications is a 150-question module, specifically designed to improve diagnostic decision making. This premier product rounds out the SANS catalog, helping surgeons as they enter practice and prepare for the ABNS Oral Examination

each type of online product, it is apparent that, in the aggregate, these products have a positive impact on the students' or practitioners' preparations.

Ultimately, there is ample evidence that online educational products are popular among practitioners and residents. Though it is challenging to measure the impact of any individual resource on education when used in the aggregate, these do have a positive effect. There is no "one-size-fits-all" online content and much of the value relies on the motivation of the student as much as the quality of the material and medium. In our current age of medicine, online resources will remain a mainstay in neurosurgical education. ■

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The Future of Medical and Neurosurgical Education: Three Drivers, One Revolution

'The brain is the organ of destiny. It holds within its humming mechanism secrets that will determine the future of the human race'

- Wilder Penfield, MD

This line, uttered by American-Canadian neurosurgeon, Wilder Penfield, describes how something seemingly personal and context-specific, an individual's brain, acts to achieve a greater impact than on the mere personal level of the individual.¹ Similarly, medical and neurosurgical education may be considered isolated entities of the institution, where individual fate can be determined in a specific context, yet little achieved on a wider scale. However, the trajectory and purpose of medical education are changing along with the healthcare landscape at large, driven by societal, economical and ethical challenges, and leveraged by technological innovation.² Technology is playing a large part in bringing education closer to clinical care; through simulation, the 'flipped classroom', video-based education, clinical outcome measures of education, or through collaboration with clinical colleagues at the educational level. Curricula are increasingly driven by need rather than tradition, and competence in the clinical environment rather than textbook knowledge is becoming a marker of educational outcome.

Neuroscience is changing the way we teach, and pedagogy is migrating into the biological neurocognitive world, away from the world of anecdote and tradition. The Sponsoring Institution 2025 project was commissioned by the ACGME's Board of Directors and identified three major drivers that unite healthcare and medical education. These drivers include democratization, commoditization, and corporatization. These concepts reinforce some of the structural changes occurring where technological innovation is driving education away from the classroom setting and into virtual learning environments. Simpson and colleagues described the competent clinicians of the future as 'superb communicators, fluent with digital



data and technology, agile and innovation-driven, and capable as leaders and members of inter-professional teams'.³ The role of educators goes beyond teaching learners the content knowledge of our specialty, to also preparing them in a multidimensional manner to deliver effective clinical outcomes. So, what is the future?

The growing involvement of neuroscience

The neuroscience of learning informs the way we can utilize what we know regarding how the brain reacts to information, how humans learn, and how this learning is best retained and applied in a clinical setting to develop the most effective educational methods. This view has been popularized by books, such as 'Make It Stick'⁴, and the scientifically based educational context found therein—such as interleaving, retrieval practice, spacing and the testing effect—are the foundation of many of the new curricula within medical schools and postgraduate clinical training. The actual evidence for how we learn will thus inform the education we provide, just as evidence-based and value-based care are changing the clinical realm.

Increasing role of educational technologies in curricula and assessment

Technology is having a significant impact on all aspects of life within and beyond healthcare. It is no surprise that technology will also help shape the future of medical education, both in the delivery and assessment of education. Some of these new delivery methods have already gained considerable traction, including the ‘flipped classroom’ approach enabled by video-based education, augmented reality (AR) or virtual reality (VR) that enable immersion into a complex clinical environment from an early stage, and adaptive learning and AI-enabled testing software powered by the principles of the neuroscience of learning. The flipped classroom is based on the idea that asynchronous learning through video-based content and self-assessment, complemented by focused classroom problem-solving settings, will improve learning outcomes and better prepare learners for the environment at the clinical frontline.

Similarly, AR/VR will also influence medical education with particular promise in the surgical and neurosurgical space.⁵ Several innovative companies have developed approaches to simulate the operating room, surgical planning, and surgical decision-making. These simulations allow learners to learn with a level of contextual fidelity never seen before and practice rare clinical events with infinite variations. In addition, online learning platforms use adaptive learning algorithms that harness the principles of neuroscience that allow us to learn more effectively.⁶

Data analytics and Learning Outcomes closer to the real-life clinical realm

With the advent on new learning technologies, and the drive towards competency and evidence-based education, the future of medical education will benefit from and be challenged by vast amounts of qualitative and quantitative performance data with regards to educational outcomes. This wealth of data will impact both the individual’s learning process, as well as the institutional delivery and assessment of curricula. On an institutional level, medical schools and residency programs will have access to a vast amount of longitudinal data on their trainees’ performance, radically changing the processes for assessing trainees in the workplace, and for carrying out remediation.³ The rise of the field of ‘learning analytics’ will help faculty, program directors, and competency committees to interpret all this data, enabling continuous modification of curricula and teaching to fit the needs of the learners.³

The Future: Better Medical Education for Everyone, Everywhere?

The future of medical education is promising and challenging. The onus on educators is not only to provide education, but to do so in an effective, engaging way, driven by neuroscience, evidence, and clinical outcomes. The democratization and commoditization of education

has meant that learners can ‘shop around’ for the best education, and increased competition means that institutions have to differentiate themselves vis-a-vis other institutions and private corporations that have successfully entered medical education, or collaborate more effectively. The technological development has enabled more effective educational methods and assessment mechanisms, and also made high-quality, peer-review, and scientifically sound medical education available anytime, anywhere. Whereas many topics could once be taught only within the walls of the institutional bastions of academia and healthcare, learners can now engage in education through online learning, video platforms and learning communities, all independent of geography.

Medical education research has not traditionally been considered a priority topic in neurosurgery; however, the field holds unique promise to demonstrate how a challenging clinical environment can benefit and act in synergy with the most effective education, rather than hinder it. Worryingly, the literature is clear that the basics of neurosurgery are currently under-delivered in virtually all medical schools in the United States, with 59% of medical school deans not considering neurosurgical knowledge as ‘essential’.⁷ This is one of many areas of medical education, where neurosurgery can truly lead the way into the future of medical education, by embracing some of the changes discussed in this article—neuroscience-grounded, needs-based medical education, driven and shaped by real-life data and evidence.⁷ Neurosurgery has a role in leading the charge into the future by embracing these changes and challenges, and just like in Wilder Penfield’s notion of the human brain, be part of the future destiny. 

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Reducing Health Literacy Barriers to Improve Patient Understanding



Health literacy studies have garnered attention among health practitioners, researchers, and policy makers. Findings from the first survey of adult literacy skills in industrialized nations conducted in the 1990s worried those in the education and economic sectors^{1,2} and spurred health researchers to examine implications for health. By 2004, a substantial body of literature indicated that people with limited literacy skills face more health problems than do those with stronger skills. They are less likely to engage in preventive care or to successfully manage a chronic disease. They are more likely to face increased hospitalizations and indicate worse health status^{3,4}. Studies also demonstrated a profound mismatch between the lay public's literacy skills and the demands and assumptions of health materials, resulting

in a proliferation of information that cannot be easily used.

Initially, health literacy inquiries were focused on the skills of the public and health outcomes. Health literacy was defined as "the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand, and use information in ways which promote and maintain good health."⁵ This definition afforded limited opportunity for intervention within the health sector and left the responsibility for improvement with those in education. A deeper understanding of the interactive nature of literacy helped expand options for action with a focus on the quality of health information, the communication skills of health professionals, and the characteristics of health institutions. This

concept of health literacy as an interaction supports action to make health information and health services more accessible and healthful action more feasible. We draw from health literacy studies and literature to highlight some recommended actions.

Navigation

Complaints about navigating the U.S. health care system are ubiquitous. People get lost in paperwork and in the hallways. Accessible information technology can help embed health literacy practices into institutional activities to support providers and patients. The identification and mitigation of barriers, an application of 'universal precautions' related to health information, and systems redesign can improve access to information and care. Assessment tools and suggestions for institutional change that focus on a 'health literate organization' are readily available^{6,7}.

Health Education

Critical health education takes place when patients talk with their providers or when community members engage with public health workers. Professionals are using teach-back to take responsibility for the communication, to increase peoples' knowledge and self-efficacy, and to lower readmission rates⁸⁻¹⁰. Professional schools are encouraging students to state 'let's check to see if I was clear and included all the key information'. Similarly, asking 'have I explained this clearly?' rather than 'do you understand?' shifts responsibility to the speaker. Studies indicate that people with low literacy skills are uncomfortable asking questions or advocating for themselves and professionals are encouraged to

solicit inquiries by noting, ‘Many people have questions about this. What are your questions?’ In addition, many medical and nursing schools are now incorporating a ‘second language’ approach in their training. Students are encouraged to use common language and define technical words—including *regular*, *normal*, *risk*—and to provide examples when feasible.

Health education efforts are supported by written material, such as pamphlets and follow up directions. Findings from thousands of assessment studies indicate that most health materials are too difficult for patients to understand or use. However, while we all rely on educational materials, few among us are responsible for developing them.

To improve the situation, institutions may insert literacy related provisions in their contracts with vendors responsible for the materials – such as proof of pilot testing with members of the intended audience and reports of assessment scores. Many tools and checklists are freely available online for assessment processes. At the most basic, ‘readability assessments’ offer an indication of reading level. The SMOG, for example, focuses on word and sentence length to offer a measure of difficulty. Other tools offer a more nuanced assessment by focusing on key issues such as purpose, vocabulary and organization. The CDC’s *Clear Communication Index* includes attention to organization, accuracy, cues for action, and math demands. The AHRQ’s *PEMAT* focuses on ‘understandability’ and ‘action-ability’. The *PMOSE/IKIRCH* assesses displays such as lists, graphs, and charts. Other tools, including *Health Literacy Online.gov*, provide guidelines for simplifying the user experience and offer checklists for review.

Each of these tools is useful for assessments as well as for the development of new materials. Staff members should become familiar with these tools so that they can make decisions about material worth purchasing and distributing. So too should researchers and practitioners so that newly

developed materials incorporate findings and innovative suggestions from the field.

Decision Making & Consent

Attention continues to be paid to the legal jargon and mandated language in consent documents and many institutions offer plain language ‘translations’. In addition, patients faced with a consent process or medical decision also grapple with numbers, fractions, percentages, ratios, or sophisticated concepts such as *risk*. Health professionals can help patients by doing calculations for them whenever possible¹¹ and by using a uniform approach to numbers. Writers and speakers should use the same denominators when they use fractions and not switch between fractions and percentages or between percentages and ratios. Well-designed displays, such as those using pictograms, can offer clarity and help patients compare and contrast options. Institutions must support their professional staff by providing rigorously designed and evaluated materials to be used with patients and families facing options and making decisions.

Conclusion

Health literacy inquiries and implementation studies continue to grow thanks to the contributions of health professionals in a wide variety of fields. When providers and researchers pay attention to the mismatch that can occur between individuals’ literacy skills and system demands, they can support healthful action. Health professionals can critically examine their talk and the materials they distribute with attention to vocabulary and numbers. At the same time, health professionals must be supported in their efforts to increase access to information and care. This can only be done through changes in health institutions. All people, regardless of skill level, benefit from having clear directions and explanations. Best practice involves the promotion of ‘accessible’ information and accessible services. 

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The Changing Role of CME

As the practice of neurological surgery becomes increasingly complex and specialized, it's more important than ever for continuing medical education (CME) to keep up with the rapid pace of neurosurgical progress. Practicing neurosurgeons rely on CME for more than updates on the latest clinical science. In the face of substantial time constraints introduced by clinical documentation requirements, quality reporting initiatives, and administrative burdens, physicians enjoy little protected time for enhancing their own clinical skills and knowledge base.

With the explosion in information technology, users can access the latest guidelines more quickly on their cell phone than we can learn from an expert. The currency of CME programming is therefore no longer information transmission. Effective CME must become an educational home for neurosurgeons to efficiently find resources that translate scientific discovery into clinical practice. These curated programs provide an opportunity for problem-solving, skill development, mentorship, and peer-to-peer exchange that promotes insight and judgment.

Self-contained educational approaches historically focused on information exchange must be replaced by programs that stimulate curiosity, create engagement, drive meaningful learning, and support behavior and practice change through feedback, opportunities for reflection, repetition, and reinforcement over time.

Promoting Self-Awareness

Key to this process is promoting self-awareness and insight into our own knowledge gaps. Misplaced confidence consistently leads to errors that clinicians may not be aware of and can result in poor patient outcomes. The average practicing neurosurgeon, by any standard, must distinguish themselves academically and professionally to even reach independent practice. After a lengthy residency training and oral board certification process, it's quite natural to entertain a sense of accomplishment. The confidence and mastery required to embolden neurosurgeons to operate on the human brain and spine may run counter to the humility and self-awareness of our limitations required to continuously improve.

To become self-aware, we must step out of the apparent cocoon of self-confidence and become humble and open enough to assess our level of skill and areas where we need to grow. For neurosurgeons, this requires careful examination of those humbling

cases when we achieve our technical goals but fail to alter the natural history of an unforgiving disease. As a specialty, we can push the intensive and extensive margin of our understanding. We must further look closely at those circumstances when our patients suffer complications, scrutinize our technique and medical management, identify opportunities for improved patient selection, and make sure we are appraised of changing technical approaches. Adaptive learning can promote self-awareness: educators can use adaptive learning to assess individual learner's needs, create personalized education aimed at addressing those gaps, provide formative assessment, and motivate ongoing progress.

Innovation in Learning

In previous iterations of CME content, lengthy didactics supported by enduring materials (journal articles, textbook accompaniments) required intensive effort to digest. The opportunity cost for practicing neurosurgeons to take time from their practice further limits the possibility of gold-standard access to face-to-face CME instruction. Web-based platforms provide specialty educational organizations with the ability to impact neurosurgical outcomes through development of educational content that is relevant and accessible. This emphasis reconciles the changing demands of the neurosurgical learner with proven, high-yield educational approaches. Effective CME becomes integrated into neurosurgical workflow and is presented in a manner that mirrors the point-of-action needs of the end user. CNS offerings like NEXUS and clinical guidelines represent vanguard efforts to provide educational content in the moment patients receive neurosurgical care.

Technology lends itself to learner-controlled training that accommodates diverse learning styles and is particularly well suited to surgical training for younger surgeons who are comfortable in the digital world. For example, a surgical procedure can be broadcast live via social media, affording neurosurgical teams around the world the opportunity to observe the procedure in real time, ask questions, and discuss their observations.

To perform successful and safe procedures, neurosurgeons and their teams need to learn together. Educators need to identify opportunities to offer interprofessional continuing education (IPCE). Simulation technologies, for example, can provide safe, controlled environments where neurosurgeons and their teams can practice

new neurosurgical techniques without posing risk to patients. This environment not only builds technical skill but allows teams to develop the competencies for interprofessional collaborative practice, such as communication skills, trust, and respect for each other's roles and responsibilities.

Mentorship, where expert neurosurgeons support their peers in informal and workplace environments, is important for the development of high-quality professional practice. Connections between colleagues and peer-to-peer learning and support not only drives practice improvement, but helps clinicians build resilience and mitigate burnout. Our professional societies help maintain these shared cultural experiences that begin in training and foster the comradery of our unique neurosurgical community.

As CME evolves, faculty will need to learn to deliver education using innovative approaches and technology. Faculty development counts for CME—and CME can support faculty in this evolution. These CME programs could focus on the balance required for modern surgeon-scientists, the development of a clinical subspecialty practice, the evolving role of residency and fellowship in the training of a surgeon, and collaborations with foundations and industry partners in the development of new neurosurgical technology.

Role of Accreditors

Although accreditation systems are sometimes perceived as burdensome, with an excessive emphasis on compliance, they are evolving to better meet the needs of emerging generations of clinicians and to encourage continuous improvement in clinician competence and performance. Accreditors are developing education strategies that will enable health system leaders, educators, clinicians, and teams to respond quickly to changing practice in neurosurgery. For example, a new collaboration between the Accreditation Council for Continuing Medical Education (ACCME), which sets the standards for organizations that provide CME (including CNS), and the American Medical Association, which administers the AMA PRA Category 1 Credit system, has freed educators to customize their offerings and to more readily apply innovative education strategies that do not fall into traditional formats.¹ With this collaboration, educators can employ approaches such as the ones described here, hybrid or blended learning, procedural training using virtual reality,

gamification, online case discussions on social media, and other approaches, to meet the needs of their learners.

The changing role of accreditors means they are not only responsible for establishing core standards for educational excellence and independence from commercial influence, but also for designing standards that serve as a guidepost for the future of CME.² ACCME's new commendation criteria, for example, recognize the achievements of accredited organizations that support interprofessional collaborative practice; address priorities in patient safety, public health, and population health; collaborate with health systems and communities; create individualized learning plans; design education to optimize technical and procedural skills; leverage educational technology; and demonstrate meaningful educational and clinical outcomes.³ These changes are reflected in some of our existing neurosurgical offerings with an expansion of interactive, case-based educational formats, inverted classrooms with webinar components, hands-on surgical skills labs, and point-of-care educational platforms like NEXUS.

Transforming CME means transforming the role of accreditors from compliance authorities to coaches and leaders that support the community of educators, provide services that respond to educators' concerns and needs, and create an environment where they can share best practices. With this new role, accreditors create a framework that motivates educators to achieve their full potential and empowers them to deliver CME that drives meaningful change in clinician performance and in the quality and safety of care for the patients we all serve. 

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Neurosurgery Resident Education: A Twist on the Traditional

The education of neurosurgical residents is of paramount importance in academic neurosurgery programs. Well-trained residents not only manage the clinical service, but also serve as mentors to more junior residents and medical students, promote the specialty and the department, and form the future of our profession. No less important is the immense sense of satisfaction felt by an attending as we watch our residents grow and develop their skills, knowing we played a role in their success.

Educating our future workforce, however, is no easy feat. There are several major challenges that must be overcome. The volume of information that needs to be mastered is daunting, and clinical obligations frequently limit the amount of time that can be devoted to education. Fatigue and frequent clinical distractions often make it difficult to maintain a high degree of engagement during formalized learning sessions. Furthermore, unlike most other educational environments in which knowledge and experience are relatively uniform across students, residents range from interns just out of medical school to chief residents about to enter practice. It can be difficult to design activities that are appropriate for all levels without being too advanced for the junior residents or too simplified for the seniors. As a result, formal didactic resident curricula in neurosurgery are rare, and learning is often comprised of lectures and case presentations, with the vast majority of information being self-taught.

Thankfully, there are alternatives to traditional methods. Recent advances in adult learning theory have revolutionized preclinical and clinical training across a number of specialties, and novel pedagogical methods have emerged. One such example is the

'flipped classroom', where students review materials ahead of time in order to maximize the value of in-classroom discussion.¹ In contrast to traditional classroom instruction in which ideas are introduced in a lecture and subsequently applied during homework assignments, the flipped classroom involves introduction to relevant concepts during a self-directed independent study period followed by application of ideas in a facilitator-guided, interactive setting.² This provides a novel approach to neurosurgical education.

Does the flipped classroom concept work in neurosurgery?

We put this idea to the test by designing a flipped classroom curriculum for all twelve residents in an academic neurosurgery training program based on 40 mentored discussions.² Each discussion was focused on a particular topic, such as aneurysms, gliomas, brachial plexus injury, etc. Weekly, each resident was randomly assigned to research a specific aspect of the assigned topic appropriate to his or her level of experience: junior residents about what characterizes each clinical entity, mid-level residents about when to intervene, and chief residents about how to administer the medical or surgical treatment. During the sessions, a neurosurgical faculty member was present and available to answer questions, but the discussion was resident-led allowing the residents to educate each other. Six months after implementation, residents completed an anonymous survey about the program, and performance on the written board examination was assessed before and after implementation of the curriculum.

> THE PRINCIPLES OF FLIPPED LEARNING HAVE MANY ADVANTAGES FOR RESIDENT EDUCATION COMPARED WITH TRADITIONAL INSTRUCTION TECHNIQUES... THE MAIN ADVANTAGE IS THAT RESIDENTS BECOME MORE ENGAGED IN THE LEARNING PROCESS BECAUSE THEY ARE RESPONSIBLE FOR TEACHING THEIR COLLEAGUES. <



Advantages of Flipping the Neurosurgery Classroom

The principles of flipped learning have many advantages for resident education compared with traditional instruction techniques involving didactic lectures and case discussions. The main advantage is that residents become more engaged in the learning process because they are responsible for teaching their colleagues.^{3,4} Also, the collaborative discussion mimics a real-world problem-solving environment, and allows each resident to bring their level of expertise to the discussion. Junior residents who recently completed medical school share their understanding of basic pathophysiology and pharmacology, while more senior residents impart their proficiency in clinical management and surgical techniques. Furthermore, each resident is able to personalize their learning when preparing for the sessions, allowing them to study at their own pace using their preferred methods and resources. Finally, faculty preparation time is reduced, and a more efficient learning environment is created, as in-class time is no longer absorbed by didactic instruction.⁵

In summary, the flipped classroom is a viable approach to resident education that is positively viewed, engaging, and associated with improvements in test performance. Although larger studies are needed to quantify the impact of this technique, our data suggests that the approach offers a promising and pragmatic alternative to didactic resident education that may be associated with improved knowledge and board performance. ✖

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Not only did resident performance on the written examination improve (from a mean of 316 to 468, $p < 0.05$), but we also found that feedback was overwhelmingly positive. Residents stated that distribution of the workload made it possible to "cover more than could be accomplished working independently" and this led to a "sense of teamwork and camaraderie" as they learned to rely on each other. The division of labor across different degrees of complexity made the activity appropriate for both junior and senior residents, allowing everyone to contribute based on their own level of knowledge and experience.



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Burnout in Resident Training Does it Matter?



The 2012 statement of the CNS, AANS, ABNS, and SNS on Ensuring an *Adequate Neurosurgical Workforce for the 21st Century*, highlights the challenges organized neurosurgery faces for the future. It is clear that maintaining an adequate supply of competent neurosurgeons to provide quality healthcare for Americans is in jeopardy. Factors including the aging population, improved insurance coverage for Americans, and the evolution of new and novel treatment options in our field are driving the need for quality neurosurgical care. Just as important, however, are training factors, including the minimal growth in supply to satisfy this large increase in demand. These challenges, coupled with the lengthy training process necessary to obtain competence, difficulty recruiting new providers to our rigorous specialty, and the lack of appropriate alternative providers to treat neurosurgical conditions, further threaten any resolve. Lastly, there is the silent but real menace of burnout that spreads an invisible layer of suppression upon possible progress in this arena.

Burnout is a psychological state coined by Christina Maslach in the 1970s characterized by the three cardinal symptoms of emotional exhaustion, depersonalization, and reduced personal accomplishment.¹ Recent studies show that more than half of physicians in the United States experience burnout (54.4%), a much higher rate than the general working population (28.4%).² This high level of burnout seen among physicians is likely multifactorial. Many of the characteristics that lead to our success also put us at risk, including the common type A personality and a perfectionist, workaholic mentality. The invisible weight of caring for sick patients, escalating documentation requirements, challenges maintaining work life balance, and the impending legal ramifications of our decisions are further pushing the pendulum towards burnout.

Residents have the additional burden of a high level of responsibility coupled with a low level of control, making them further susceptible to burnout. Pairing this with the lengthy and emotionally challenging nature of neurosurgical training, most would hypothesize the neurosurgical burnout would equal or exceed averages among all specialties. Recent studies, however, showed a national survey of neurosurgical trainees reporting a prevalence of only 36.5%.³ Should we applaud ourselves over this relatively low prevalence, basking in the possibility that our field has recruited more resilient individuals? Is this number even reliable or purely a

byproduct of a subliminal but potent mentality within competitive specialties to never show weakness? Or does it even matter? Even if accurate, a third of our trainees are experiencing burnout prior to transitioning to independent practice. With an already suboptimal ratio of neurosurgeons to persons, and a stagnant 160 trainees graduating yearly, burnout poses a powerful hazard to the future neurosurgical workforce.⁴

In the setting of burnout, everyone pays a price. This includes patients, with burnout leading to notable increases in medical errors and malpractice rates, as well as lower patient compliance. Burnout has also been linked to diminished patient satisfaction attributed to decreases in physician professionalism and engagement. There are threats to the personal health of our trainees, with elevated rates of depression, suicidal ideation, insomnia, and substance abuse all of which are elevated in a state of burnout.⁵ Families also suffer, as the effects of burnout suffocate the remaining physical and emotional energy one has left when returning home from the workplace.

Even more worrisome is the relative unspoken nature of these serious issues and the lack of solutions to skillfully address them. The difference between stress and burnout is considered the ability to recover during your time off; however, neurosurgical residents facing the demands of years in apprenticeship and a profession that demands competence and perfection often lack the freedom to recognize burnout and resolve it with time away. The medical community suggests education about burnout, workload modifications, stress management training, emotional intelligence training, and wellness workshops as solutions to address burnout in training. Logistically, however, this is nearly impossible and likely underestimates what is necessary to combat this epidemic. Such education would compete with both the limited allotted time to gain proficiency in our complex specialty in the era of duty hour restrictions and the minimal time off trainees have to re-energize themselves. Minimizing workload is nearly impossible in a system where residents remain a central asset to the continuous service provided to health care systems in support of neurosurgical patients. And where does the responsibility even fall? Is it at the program level, the administration, the graduate medical education office? Overall it is clear that resident (and truly physician) burnout matters. The less crystal discussion revolves around the resolutions which remain in their infancy and are poorly defined. Our residents as well as our profession as a whole are in crisis. Unless

> IN THE SETTING OF BURNOUT, EVERYONE PAYS A PRICE. THIS INCLUDES PATIENTS, WITH BURNOUT LEADING TO NOTABLE INCREASES IN MEDICAL ERRORS AND MALPRACTICE RATES, AS WELL AS LOWER PATIENT COMPLIANCE. <

changes in the healthcare system and training processes occur, including addressing the subliminal factor of burnout, these crises will persist. The conversations to address this need to start now. ■

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Elad Levy, MD



E. Sander Connolly

An update from the ABNS about the Continuous Certification (CC) Process

I Professionalism and Professional Standing

The guiding principle of continuous certification (CC) is to foster excellence in patient care. The ABNS intends to encourage, stimulate and support continuing education in the practice of neurosurgery to assist its diplomates in their dedication to lifelong learning and self-assessment through CC.

The CC program is designed to allow diplomates to meet requirements as they continuously work to be current with changes in the specialty. The CC program reflects the realities of today's neurosurgery practice. Emphasis is placed on core neurosurgery knowledge and practices common to all neurosurgeons. However, the ABNS realizes that neurosurgeons often concentrate in various subspecialties. The process has been designed to permit participants to include their subspecialty expertise when devoting time to CME activities and selecting a module for the CC Part III learning tool.

II Lifelong Learning and Self Assessment



Significant changes have been made to the CC process over the last year. The primary goal was to minimize the burden on neurosurgeons while elevating the standards to provide the best care for our patients. The new Continuing Certification process is as follows:

- All Continuing Certification requirements are now required to be completed annually. You will be notified via email by the ABNS office how and when to complete them.
- The Chief of service letter can be filled out by any senior partner or colleague, who can certify that the ABNS diplomate has an unrestricted medical license and hospital privileges.
- This Chief of service letter will also specifically attest to the following: 1) the diplomate maintains meaningful participation in patient safety training exercises at the diplomate's institution, and 2) participates in, at least, quarterly Morbidity and Mortality

conference (local or national) where the diplomate's own cases and complications are discussed. If desired, attestation of active participation in the AANS QOD registry project can serve as an alternative to the M&M requirement and can be attested to by the Chief of service at your primary hospital.

- There is now a requirement that 20 AMA PRA Category 1 CME Credits™ need to be obtained and submitted annually. It should be noted that some of these credits will be automatically granted as a result of completion of the cognitive tool.
- All self and external cognitive assessment will be fulfilled by taking the new CC adaptive learning tool, designed to by Dr. Richard Ellenbogen. This tool will keep you up to date on acute issues that may arise when you take call and satisfies the requirements for coverage at an ACS certified trauma center.

III

Assessment of Knowledge, Skills, and Judgement

This new online tool can be utilized 24/7 from the diplomate's own computer. While the content is tailored to update "core neurological surgery" knowledge by focusing on new evidence-based concepts most critical to providing emergency, urgent or

IV

Improvement in Medical Practice

critical care, there is also content on endovascular, pediatric and advanced critical care for those participating in the three ABNS/ABMS sponsored recognition of focused practice (RFP) programs. [▶](#)

> THE CHANGE IN 2018 FROM THREE-YEAR MINI-CYCLES TO ANNUAL MINI-CYCLES WAS INTENDED TO MAKE THE CONTINUING CERTIFICATION PROCESS TIMELIER AND MORE RELEVANT, WITHOUT INCREASING THE BURDEN ON DIPLOMATES. <

– E. SANDER CONNOLLY

BOOK REVIEW



CNS

Educated, A Memoir by Tara Westover



Martina Stippler, MD

Many of us cherish education, and as neurosurgeons, we must. How many years do we spend in school, then college to qualify for medical school to then enter a long resident and even fellowship? By the time we treat our first patient as an attending, we have spent 80% of our life in one form of education or another.

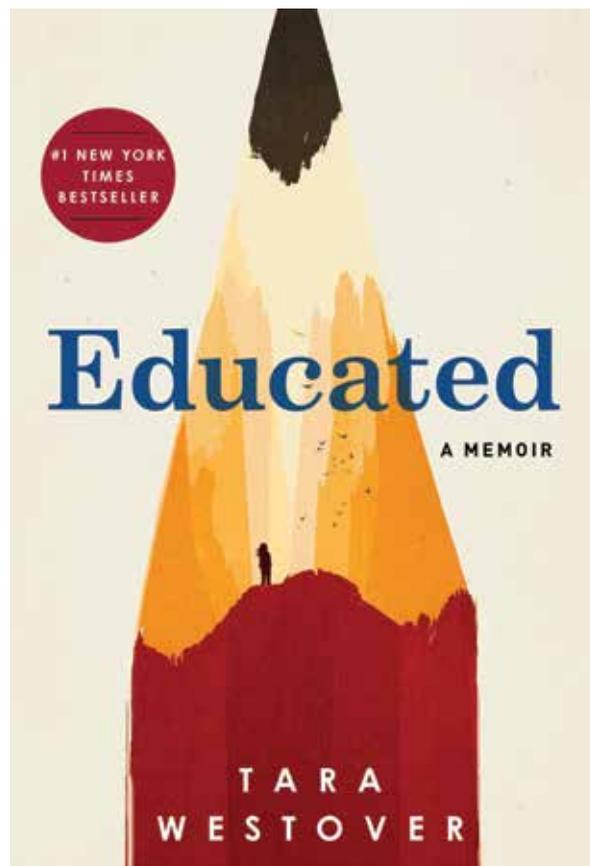
Educated is an extraordinary memoir of a young woman discovering the value of education and how the knowledge she gains changes her and her relationship with her family forever. Born to survivalist family in rural Idaho, author Tara Westover is not only kept away from public school, but her home-schooling consists of reading the bible. She does not even have a birth certificate.

Tara's self-motivation is almost palpable throughout the book. Despite the most difficult family circumstances Tara ends up with a PhD in history from the Cambridge University. Her father, who is deeply religious, believes in God's control over everything which makes him shockingly careless in the junkyard and in his life. Westover details horrific injuries and accidents that she and her siblings suffered. Her parents' obvious disregard for the health and wellbeing of Tara and her siblings is shocking and even more evil as it is cloaked under the religious righteousness. Her eldest brother, Shawn, returns from his attempt to break away from the family and cultivates a fondness for Tara which turns into sickening head games and violent abuse.

Tara's world comes close to our own when her older brother is injured while building a barn with his father and undergoes brain surgery for an epidural hematoma. Tara muses over whether her father put his fear of doctors and the government aside to call for help for his injured son, or if others did it. The account of the accident is not clear, and people present remember it differently. Tara would have hoped that her father cared for her brother, and indirectly for her, more than is believed, but she never found an answer.

Tara's story is a good example of how education changes us, and how worldviews are formed by the information we seek out and believe. This also holds true for us neurosurgeons, to seek out an education and wisdom to offer the best state of the art treatment for our patients.

The book *Educated* is an unbelievable account of a women journey geographically, academically and ideologically from a perilous junkyard on a mountain in Idaho to a doctoral degree in history in Cambridge. 📖



Neurosurgeons Speak Up

We asked our members *“What is the one thing you wish you would have known in your first year out of Residency?”*

In the first year every things is new and every duty day will yield different experience, having said that; their isn't single-way to approach and treat patients, also, be patient in regards to (OR) training time! The more you know the more you see.

— Seraj Ajaj, a neurosurgery resident at Ali Omar Askar-Neuro Hospital Tripoli, Libya

The basics of business including coding, reimbursement and tricks to optimize clinical schedules. The sooner I could learn these fundamental skills the better!

— Erika Petersen MD, University of Arkansas for Medical Sciences

Neurosurgery is self-selecting.

— Matthew Stephenson, UCSF Skull Base and Cerebrovascular Laboratory

WINS Update



Jennifer Sweet, MD

This past October, after an extremely successful year, the AANS/CNS Joint WINS Section transitioned in leadership from Ann Parr, MD, PhD, Chair of the Section from 2017-2018, into my hands, where I hope to continue the impressive growth and forward trajectory of our Section. I am fortunate to be joined by an amazing team of leaders, including Chair Elect, Martina Stippler, MD; Secretary, Ellen Air, MD, PhD; Treasurer, Sarah Woodrow, MD; and Executive Committee Members –Sheri Dewan, MD; Alia Hdeib, MD; Maryam Rahman, MD. We are also privileged to have the continued support of past leadership, as well as increasing interest and involvement by faculty, residents, and medical students alike.

The mission of WINS is to educate, inspire, and encourage women neurosurgeons to realize their professional and personal goals, and to serve neurosurgery in addressing the issues inherent to training and maintaining a diverse and balanced workforce. In the spirit of this, WINS has taken an active role in leadership, mentorship, and education within organized neurosurgery, and has benefited from the support of such efforts from our parent organizations. Listed below are some highlights from the past year:

- Expansion of the Section membership since 2017 by nearly 13%!
- WINS held an extremely well-attended Satellite Symposium, in conjunction with the Spine Section Meeting March 16, 2018, hosted by Drs. Ann Parr and Marjorie Wang and sponsored by Medtronic. Guest speaker, Gae Walters, discussed the Psychology of Leadership.
- Launch of an impressive WINS Mentorship-Match Program, organized by Dr. Maryam Rahman.
- Hosted Angela Duckworth, Founder and CEO of Character Lab and author of a #1 *New York Times* best seller, *Grit: The Power of Passion and Perseverance*, as the Louise Eisenhardt Speaker during the AANS 2018 meeting. She gave a phenomenal

lecture, preceded by a compelling interview with Dr. Ann Parr during the Louise Eisenhardt Breakfast.

- Partnered with the CNS on the inaugural International Women's Think Tank Summit meeting, during the CNS Annual Meeting. The event, which was sponsored by Stryker, served to discuss obstacles and opportunities for women neurosurgeons across the globe.
- Presented the annual WINS/Greg Wilkins-Barrick Chair Visiting International Surgeon Award (VISA) to Dr. Idoya Zazpe from Spain, through the generosity of Toronto neurosurgeon Mark Bernstein, MD, FAANS, as well as the Sherry Apple Resident Research Award to Dr. Charuta G. Furey, who presented an oral abstract on her research—both during the 2018 CNS Annual meeting.
- Established the Shelly Timmons Honor Your Mentor Fund for Leadership and saw the continued growth of the Karin Muraszko Honor Your Mentor Fund for Leadership, both with the aim recognizing and showing gratitude to true leaders in our field.

Looking forward, WINS hopes to have additional success in our membership and involvement, and we hope to continue to serve an important role in organized neurosurgery. Here are some initiatives on the horizon:

- WINS is launching a BRAINPOWER “button campaign” fundraising effort, led by Dr. Martina Stippler, to show support for women neurosurgeons. The pin can be purchased by contacting WINS via our website, www.neurosurgerywins.org.
- WINS will host a reception at the upcoming Pain & Spine Section Meeting on March 13, 2019, in Miami, Florida, great for networking and building collaborations between WINS, Pain, and Spine Section members who will be in attendance.
- At the AANS and CNS 2019 meetings, the WINS program will continue to expand its educational content for men and women neurosurgeons at all stages of their careers, pertaining to our mission of Mentorship, Leadership, and Education in an ever-changing environment and will continue to host our distinguished named lectures, awards and our Mentorship-Match Program,
- Lastly, 2020 will mark the 30th Anniversary of Women in Neurosurgery. This anniversary will also coincide with Dr. Karin Muraszko's Presidency of the Society of Neurological Surgeons, and she will be the first woman president of the SNS. As such, WINS will be planning a special celebration with our parent organizations during the annual meetings to recognize and honor these momentous events. Please stay tuned for further updates, which will be found on our website and through our bi-annual WINS Newsletter. ❏

2018 Joint Cerebrovascular Section Update



Clemens Schirmer

The AANS/CNS Joint Section on Cerebrovascular Surgery is closing out 2018 with ongoing vitality, continuing to lead in the field of cerebrovascular surgery with engagement from its members. During the past year, the Section has represented the neurosurgical community, not only within the AANS and CNS. Representation to other bodies and collaboration with other stakeholders and societies in the neurovascular space continue to be a focal point: Along with representatives from SNIS and SVIN a number of members of the Section worked on a model for a stroke delivery that was used to respond to a request for applications from the Center for Medicare and Medicaid Innovation (CMMI).

When the FDA recently called for a meeting of Neurological Devices Advisory Panel on Intracranial Aneurysm Treatment, the entire leadership of the section offered to represent our members and patients on this important matter, submitting a request to present and discuss alternatives to prospective randomized controlled trials such as use of registry data and post-market approval data collection efforts that would continue to allow of devices and therapies to benefit patients sooner. In addition, the presentation addressed surgical treatment options for unruptured, smaller (under 7mm) aneurysms, for appropriately selected higher risk patients, including but not limited to younger patients with strong family histories of ruptured aneurysms. This will again highlight the importance of participating in the Quality Outcomes Database cerebrovascular module as a critical tool in the evaluation of tracking and improving outcomes and quality. We now have around 3000 patients enrolled, across multiple centers, with more centers joining every month.

The section is open to and remains a vibrant resource across the entire lifecycle of cerebrovascular specialist, and we seek to offer value to all members, ranging from trainees who will benefit from the fellows' course during the upcoming meeting, to the now known CAST training



Dr. Ralph Dacey receiving the inaugural eponymous medal for cerebrovascular research at the 2018 annual meeting of the cerebrovascular Section in Los Angeles, CA, pictured here with Past-Chair of the Section Dr. Greg Zipfel.

selected patients to receive the benefit an expanded treatment time window up to 24 hours after onset of symptoms. Along with that comes the perhaps not surprising realization that cerebrovascular surgery as a whole has entered an era where treatment plans and practices are founded on solid evidence and risk and benefit can be better than ever defined when discussing potentially life altering surgery or intervention with our patients. We saw new high-level evidence spanning the field from coiling to stenting and are looking forward to results in the treatment of intracerebral hemorrhage.

At the same time, new and exciting opportunities lie ahead. The section continues to represent us as the only group of practitioners able to provide comprehensive care, bringing expertise ranging from radiosurgery to clipping of aneurysms to the table. If nothing else, we know that detractors pointing out any of these modalities are niches, bound to disappear and likely proven wrong within a short while.

Our next meeting in collaboration with SNIS will be in Honolulu, HI and the onus is on us to show and exchange ideas with colleagues from all over the world, especially with our colleagues from Japan who will hopefully take the opportunity to meet us in the middle of the Pacific Ocean.

On the other end of the spectrum, the section created a new named research medal for a body of collaborative cerebrovascular research. Dr. Ralph Dacey, the inaugural recipient, was presented with the medal at the annual meeting in 2018 and will lend the medal its name going forward.

We also want to also highlight on a culture of giving in our section, having created an easy pathway that allows anyone to give money towards CV section activities using the charitable donation process through the CNS foundation or NREF foundation—either way earmarked and reserved for CV section activities. Robust giving will allow us to create the funds for more research and training activities for tomorrow which will directly influence the future of our profession and specialty. ■

INSIDE THE CNS



Washington Committee Report



Katie O. Orrico

Making Progress in the Nation's Capital—Wrapping up 2018

The CNS/AANS Washington Committee had a busy and productive 2018, making significant progress on organized neurosurgery's legislative and regulatory agenda. Some final highlights include:

- Improve the Health Care Delivery System.** Congress passed legislation funding the Children's Health Insurance Program (CHIP) for ten years. The continuing funding resolution ([H.R. 195](#)) was signed into law on Jan. 22, 2018, and the Bipartisan Budget Act ([H.R. 1892](#)) was signed into law on Feb. 9, 2018. In addition, the so-called Cadillac tax on generous health insurance plans was suspended for an additional two years to 2022.
- Support Quality Resident Training and Education.** A growing number of members of Congress cosponsored the Resident Physician Shortage Act ([S. 1301](#) / [H.R. 2267](#)), which would provide Medicare funding for an additional 15,000 residency training slots.
- Abolish the Independent Payment Advisory Board (IPAB).** After nearly a decade of advocacy, the CNS and AANS helped lead a successful effort to repeal the IPAB, which was accomplished in the Bipartisan Budget Act ([H.R. 1892](#)). If implemented, this 15-member government board was empowered to make Medicare payment cuts that would have resulted in significant reductions in neurosurgical reimbursement.
- Alleviate the Medical Liability Crisis.** The CNS and AANS moved the medical liability reform ball further down the field on several fronts. The House of Representatives passed the Protecting Access to Care Act ([H.R. 1215](#)), which included key reforms modeled after those in place in California and Texas. The president also signed into law the Sports Medicine Licensure Clarity Act ([S. 808](#) / [H.R. 302](#)) on October 5, 2018, which clarified medical liability rules for physicians traveling with sports teams. Additionally, progress was made to provide physician volunteers with medical liability protections in the event they render care during a national emergency or disaster, as the Good Samaritan Health Professionals Act ([S. 781](#) / [H.R. 1876](#)) advanced in Congress. Finally, members of Congress demonstrated their support for protecting physicians from medical liability claims when they provide services mandated by the Emergency Treatment and Labor Act (EMTALA) by cosponsoring the Health Care Safety Net Enhancement Act ([S. 527](#) / [H.R. 548](#)).
- Continue Progress with Medical Innovations.** To ensure that the U.S. continues to lead the world in medical innovation, the CNS and AANS helped lead an effort to suspend the medical device excise tax for an additional two years. This provision was included in the continuing funding resolution ([H.R. 195](#)).
- Restructure Medicare Quality Improvement Programs.** Implemented as part of the Medicare Access and CHIP Reauthorization Act ([MACRA](#)), Medicare's Quality Payment Program (QPP) continues to be a complicated check-the-box program, which is burdensome to physicians and fails to help improve quality. The CNS and AANS worked with organized medicine to include in the Bipartisan Budget Act ([H.R. 1892](#)) additional flexibility to minimize penalties for years 2021-23 and eliminate the requirement that electronic health record (HER) standards become more stringent over time, while also maintaining EHR hardship exemptions.
- Champion Fair Reimbursement.** Finally, due to the advocacy efforts of the CNS and the AANS, no changes in global surgery fees will be forthcoming

in 2019. The Center for Medicare & Medicaid Services (CMS) global surgery code data collection initiative was poised to produce cuts in neurosurgical reimbursement by at least 25 percent.

In addition to the progress highlighted above, the CNS/AANS Washington Committee and its subcommittees accomplished the following:

- **2019 Medicare Physician Fee Schedule.** Overall, in 2019, CMS estimates that payments to neurosurgery will not change. Due to the advocacy of the CNS and AANS cuts in the professional liability values were prevented and sweeping changes to evaluation and management (E/M) codes were modified and delayed. Both proposals would have resulted in a \$20 million Medicare pay cut for neurosurgery.
- **Reversing National Correct Coding Initiative Spine Code Edit.** A National Correct Coding Initiative (CCI) edit incorrectly prohibited the reporting of CPT codes 63047 and 22633 at the same interspace, inappropriately bundling decompression and lumbar fusion. The AMA *CPT Assistant* publication incorrectly confirmed the edit in October 2016, leading several private payors including Aetna and Cigna to cite the publication as a reason to adopt the edit. Through vigorous advocacy, CNS/AANS Coding and Reimbursement Committee leaders led a multi-specialty coalition to successfully convince the AMA to issue a correction in the May 2018 *CPT Assistant*. Efforts to get payors to reverse this edit are ongoing.
- **Correcting Co-Surgeon Coding for Craniostomosis.** CNS/AANS Coding and Reimbursement Committee leaders successfully advocated for CMS to reverse course and Medicare

will now reimburse a co-surgeon for the craniostomosis codes (61550, 61552, 61556, 61557, 61558 and 61559) when appropriately documented.

- **Championing Appropriate Coverage of Neurosurgical Services.** The CNS/AANS Coding and Reimbursement Committee's Rapid Response Team (RRT) continued address numerous national and state coverage issues. For example, in August 2018, Aetna updated its policy to extend coverage for expandable spinal cage devices from L2 to S1. In addition, Anthem published an updated coverage policy for Deep Brain, Cortical, and Cerebellar Stimulation, incorporating a number of recommendations from neurosurgery, such as dropping the criteria that an individual must try and fail vagus nerve stimulation (VNS) first before coverage is allowed for responsive neurostimulation (RNS). In May 2018, the Washington State agreed to cover open decompression and minimally invasive techniques that include laminectomy, laminotomy, foraminotomy and discectomy. Finally, the CNS and AANS successfully advocated for Medicare to cover (in most regions of the country) Magnetic-Resonance-Guided Focused Ultrasound Surgery (MRgFUS) for Essential Tremor.
- **FDA Adopts Opioid Recommendations.** In January 2018, **Robert F. Heary**, MD, FAANS, appeared before the FDA at a hearing on opioid Risk Evaluation and Mitigation Strategies (REMS). Dr. Heary presented testimony developed by the AANS/CNS Drugs and Devices Committee and the AANS/CNS Joint Section on Pain that included a recommendation that FDA facilitate a standardization of prescription drug monitoring programs (PDMPs) to make checking easier for physicians. Adopting our suggestions, in March, FDA Commissioner Scott Gottlieb, MD, called for a national electronic prescribing platform to help combat the opioid crisis

and to help ensure that physicians get prompts the moment they are writing a prescription. This will ensure appropriate prescribing and allow public health officials to collect nationwide data on opioid and controlled substance use.

- **Ensuring the Safety of Intracranial Aneurysm Treatment Devices.** The AANS/CNS Drugs and Devices Committee in coordination with the AANS/CNS Joint Section on Cerebrovascular Neurosurgery, developed a statement for the FDA Neurological Devices Advisory Panel meeting on March 1, 2018, recommending issues to consider in the evaluation of clinical study data to support the safety and effectiveness of intracranial aneurysm treatment devices. Attending on behalf of the AANS and the CNS and the AANS/CNS Cerebrovascular Section were **Kevin M. Cockroft**, MD; **Robert E. Harbaugh**, MD, FAANS; **J Mocco**, MD, MS, FAANS; **Clemens M. Schirmer**, MD, FAANS; **Adnan H. Siddiqui**, MD, PhD, FAANS; and **Babu G. Welch**, MD, FAANS. Neurosurgeons serving on the panel included **Julie G. Pilitsis**, MD, PhD, FAANS; **Kadir Erkmen**, MD, FAANS, **William W. Ashley**, MD, PhD, FAANS, and **Gregory Thompson**, MD, FAANS. **Christopher M. Loftus**, MD, FAANS, was at the meeting in his role as Chief Medical Officer for the FDA Division of Neurological Devices.
- **Millions Appropriated for Injury Treatment and Prevention.** The CNS and AANS successfully advocated for increased funding for injury prevention and treatment and emergency preparedness. In addition, on Dec. 21, 2018, the president signed into the Traumatic Brain Injury Program Reauthorization Act ([H.R. 6615](#)), which renews federal brain injury programs and authorize more than \$19 million annually for federal and state programs.

Looking Ahead to 2019

With the U.S. House of Representatives switching to Democratic control for the first time since 2010, and the Republicans gaining seats in the Senate, the voters in the 2018 midterm elections pulled the lever for divided government. While on election day it was more purple rain, than a blue wave, as more races were called, the Democrats increased their tally. With one race yet to be decided (as of the writing of this report), Democrats gained at least 40 House seats, but the new Democratic House majority will be slimmer than the previous Republican majority. Republicans increased their Senate majority by two seats. A surge of female candidates produced a record-breaking number of women elected to serve in the next Congress, shattering the prior record of 107 currently at the Capitol. When the dust settles, more than 125 women will walk the halls of the House and Senate, and Rep. Nancy Pelosi (D-Calif.) will once again serve as Speaker of the House of Representatives.

**The 116th Congress also includes 16 physicians,
including seven surgeons, with three new additions. They are:**

-
- | | |
|---|---|
| <ul style="list-style-type: none"> • Sen. John Barrasso (R-Wyo.); Orthopaedic Surgeon • Sen. Bill Cassidy (R-La.); Gastroenterologist • Sen. Rand Paul (R-Ky.); Ophthalmologist • Rep. Ralph Abraham (R-La.); Family Physician/Veterinarian • Rep. Ami Bera (D-Calif.); Family Physician • Rep. Larry Bucshon (R-Ind.); Thoracic Surgeon • Rep. Michael Burgess (R-Texas); OB/GYN • Rep. Scott DesJarlais (R-Tenn.); Family Physician | <ul style="list-style-type: none"> • Rep. Neal Dunn (R-Fla.); Urologist • Rep. Mark Green (R-Tenn.); Emergency Room Physician • Rep. Andy Harris (R-MD); Anesthesiologist • Rep. John Joyce (R-Pa.); Dermatologist • Rep. Roger Marshall (R-Kan.); OB/GYN • Rep. Phil Roe (R-TN); OB/GYN • Rep. Paul Ruiz (D-CA); Emergency Room Physician • Rep. Kim Schrier (D-Wash.); Pediatrician |
|---|---|
-



The CNS/AANS Washington Committee is in the process of developing its 2019 legislative and regulatory agenda, and will enlist the input from neurosurgeons in this process. Issues that will drive Congress' agenda include:

- Medicare for all/universal health care, including fixing the Affordable Care Act (ACA);
- Medicaid expansion, including Medicaid waivers and Medicaid work requirements;
- Prescription drug prices;
- Health care costs and transparency, including eliminating surprise medical bills and improvements to prior authorization processes; and
- Ongoing efforts to address the opioid epidemic.

Stay tuned for what is certainly going to be a rollicking 2019! ❖

IMAGES IN NEUROSURGERY

Cervical rib presenting with neurogenic thoracic outlet syndrome

A 16-year-old girl presented to our neurosurgery clinic with a 6-month history of paresthesias along the medial aspect of the right forearm and hand. On physical examination, she had right grip weakness and mild atrophy of the right hypothenar and interosseous muscles. A bony mass was palpated just above the right clavicle. Computed tomography of the chest showed a complete right cervical rib (**Figures 1 and 2, black arrow**), arising from the C7 vertebral body and attaching to the first thoracic rib, and an incomplete left cervical rib (**Figures 1 and 3, white arrow**). A cervical rib is the most common cause of neurogenic thoracic outlet syndrome from compression of the medial cord or inferior trunk of the brachial plexus. We collaborated with a cardiothoracic surgeon to resect the right cervical rib. At 6-month follow-up, the patient reported complete resolution of right arm paresthesias and significant improvement in right grip strength. ■

Submitted by:

Rimal H. Dossani, MD, and Anthony Sin, MD

Affiliations: Louisiana State University Health Sciences Center-Shreveport
Department of Neurosurgery

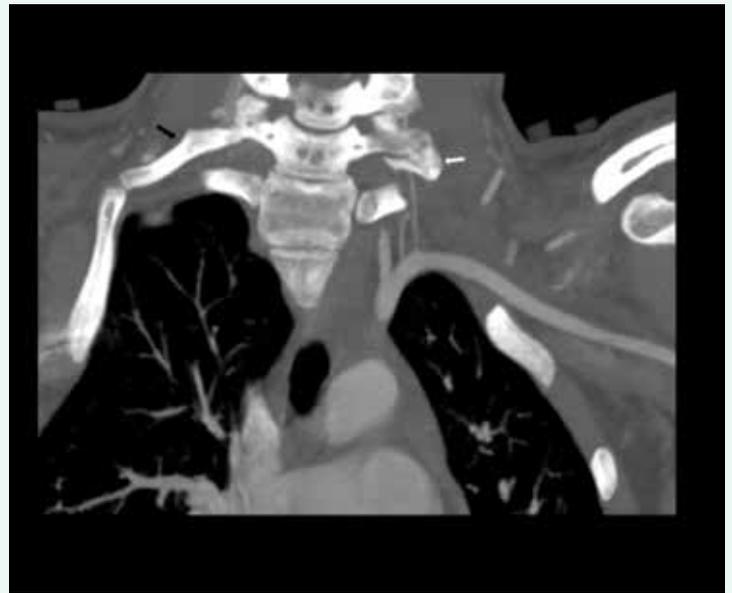


Figure 1

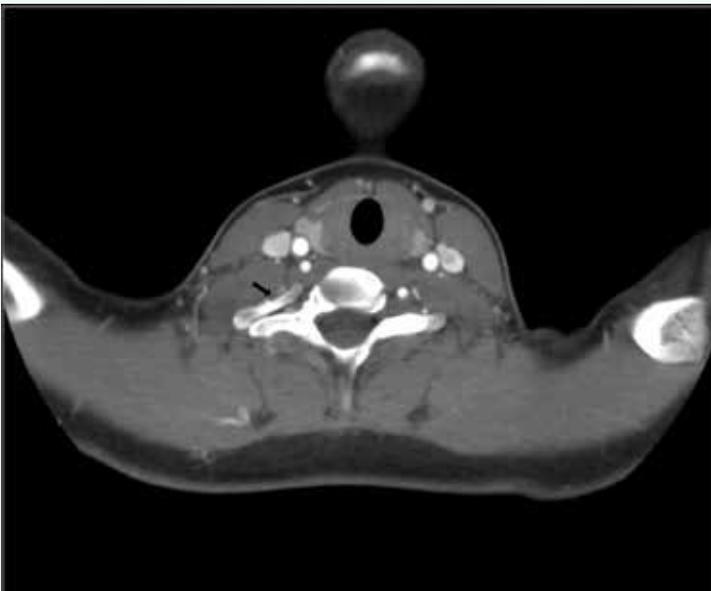


Figure 2

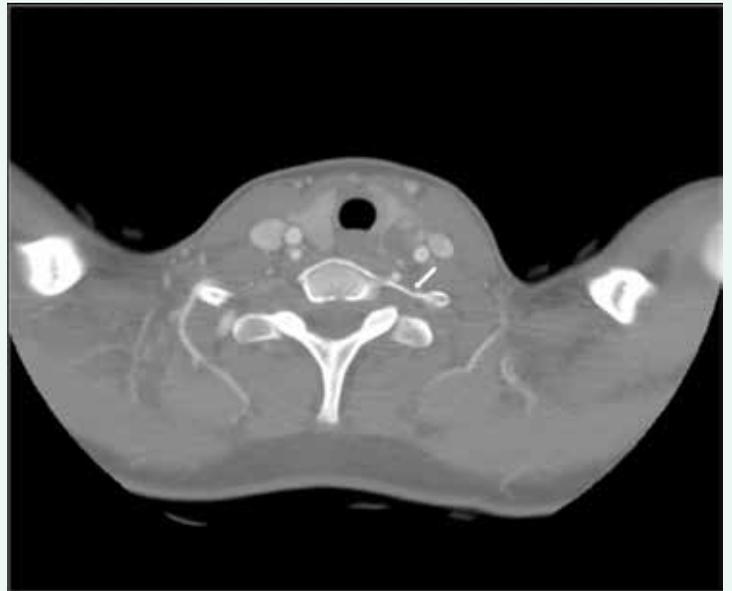


Figure 3



Congress of
Neurological
Surgeons

The CNS provides relevant learning experiences for today's practice challenges, with informative, world-class education. Discover more at cns.org.

2019 CNS Education Courses

Innovative live courses that move our specialty forward and foster collaboration and growth in our community.



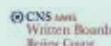
CNS Spine Complications Course

February 15–17, 2019 | Park City, Utah
Discuss your most challenging cases in a collegial atmosphere and learn strategies to improve surgical outcomes and avoid complications.



CNS Minimally Invasive Cranial Course

February 15–16, 2019 | La Jolla, California
Get up-to-date on current trends and advancements in minimally invasive cranial surgery through lectures, case-based discussions, and cadaver dissections—and learn how to incorporate these advances into your practice.



CNS SANS Written Boards Review Course

February 23–24, 2019 | Houston, Texas
Prepare for the Written Boards with the new SANS Subspecialty Modules. This high-yield course covers all general and subspecialty neuro topics with summative didactic sessions and integrated real-time testing.



CNS Oral Boards Review Course

February 23–24, 2019 | Houston, Texas
October 18–19, 2019 | San Francisco, California
Attend the biannual CNS Oral Boards Course in October or February for a multi-pronged approach to studying, with small group and one-on-one sessions. Also included are a series of study tips videos and a pre-course webinar.



CNS Leadership in Healthcare

May 10–11, 2019 | Rosemont, Illinois
This application-only course empowers junior attending neurosurgeons with the information and skills needed to shape their own careers and lead their departments, hospitals, and health systems.



CNS Vanguard Leadership in Healthcare

May 10–11, 2019 | Rosemont, Illinois
This course pairs senior neurosurgical leaders and their executive administrative partners to develop consensus around best practices for common organizational challenges facing medical centers in an evolving health care delivery environment.



CNS Acute Stroke Care Symposium

May 2019 | Chicago, Illinois
This symposium brings the entire neurocritical care team together to improve outcomes in patients with acute ischemic stroke by advancing triage and medical management of neurological emergencies.



CNS Skull Base Fellows Course

August 2019 | Cleveland, Ohio
Held at Case Western Reserve University/University Hospitals Cleveland Medical Center, this two-day course uses a combination of lectures, case-based discussions, and cadaver dissections to cover basic surgical approaches and anatomy required of every skull base neurosurgeon.



2019 CNS Annual Meeting

October 19–23, 2019 | San Francisco, California
The CNS Annual Meeting brings together neurosurgeons from across the globe for best-in-class education, science, and networking. It is the premier forum for learning cutting-edge procedures, approaches, and technologies in the field.

2019 Jointly Provided Courses



North American Neuromodulation Society (NANS) Annual Meeting

January 17–20, 2019 | Las Vegas, Nevada
Themed The Science Behind Successful Outcomes, NANS is the premier meeting to capture the latest advances in the science and practice of neuromodulation.



Joint Section on Pain 2019 Biennial Meeting

March 13–14, 2019 | Miami Beach, Florida
Expanding your Toolbox: The Treatment of Spine and Peripheral Nerve Disorders focuses on cutting-edge pain technologies, novel surgical techniques, and the science to support them.



Spine Summit 2019

March 14–17, 2019 | Miami Beach, Florida
The Annual Meeting of the Joint Section on Disorders of the Spine and Peripheral Nerves brings together surgeons from across the globe with courses, breakouts, and spirited debates on controversial topics and advances in the field.

www.cns.org

Keep your eye on the CNS website for these new courses coming in 2019!

➤ Transition to Practice Curriculum—August 2019 ➤ Tumor Complications—Winter 2019