Neurosurgical education

- Reshaping neurosurgical training: a novel simulation-based concept for structured skill acquisition and curriculum integration
- Society of MYND (Mentorship of Young Neurosurgical Doctors): a project for the ongoing education of junior faculty pediatric neurosurgeons
- A national study of neurosurgical residency competency development
- Prospective insights into pediatric neurosurgery: transforming care through adverse event analysis
- Development of a virtual dissection environment integrated into cadaveric dissection for skull base anatomy education
- Radiation safety practices in neurosurgery: Exploring education gaps and concerns among physicians and trainees
- Seeing Is Believing: Real-Life 360-Degree Virtual Reality as a Catalyst for Neurosurgical Interest
- Over 70 Years of Neurosurgical Research: A Comparison of the Publication Performance of Two Leading Journals: "Acta Neurochirurgica" and "Zentralblatt für Neurochirurgie"

Neurosurgical education is a highly specialized, rigorous process designed to train surgeons in the complex skills needed for neurosurgery, focusing on both clinical and technical expertise. The training pathway typically includes:

1. **Undergraduate Medical Education** – Aspiring neurosurgeons complete a medical degree (MD or equivalent), which generally spans 4–6 years and includes foundational coursework in anatomy, physiology, and pathology.

2. **Neurosurgical Residency** – Post-medical school, neurosurgical trainees enter a residency program that can last between 5 and 7 years, depending on the country. Residency combines hands-on surgical training with didactics, covering topics such as neuroanatomy, neuropathology, and neuroimaging. During this time, residents perform various neurosurgical procedures under supervision and gradually progress to independent practice.

3. **Fellowships** – After residency, many neurosurgeons pursue fellowships to gain advanced expertise in subspecialties such as spine surgery, pediatric neurosurgery, functional neurosurgery, cerebrovascular surgery, and neuro-oncology. Fellowships typically last 1–2 years and allow for focused, in-depth training.

4. **Continuous Professional Development (CPD)** – Given the rapid advancement of neurosurgical techniques and technology, neurosurgeons engage in ongoing education, including attending conferences, workshops, and courses to stay current on best practices and innovations.

5. **Global Neurosurgical Education Initiatives** – Organizations like the World Federation of Neurosurgical Societies (WFNS), World Health Organization (WHO), and various neurosurgical associations support global initiatives to enhance neurosurgical training, particularly in low- and middle-income countries (LMICs). These include:

1. **Online and virtual learning platforms** to provide accessible training materials and live demonstrations.
2. **Mentorship and exchange programs** where surgeons from high-resource settings provide training to surgeons in LMICs.

3. **WFNS Global Neurosurgery Committee** programs to support neurosurgical education and training in underserved regions through advocacy, resource distribution, and policy development.

These combined efforts aim to ensure that neurosurgical training is accessible, up-to-date, and globally standardized, ultimately improving patient outcomes across diverse healthcare systems.

The education and training needed to become a neurosurgeon consist of a long and demanding program that consists of acquiring a solid theoretical background and clinical and surgical experience. Residents in neurosurgery have to spend a lot of time in the operating room to become familiar with surgical anatomy and techniques and to develop practical skills [1) 2) 3)].

Halstedian surgical training refers to the surgical training method developed by William Halsted, an American surgeon who is considered one of the founders of modern surgery. The Halstedian approach to surgical training was developed in the late 1800s and early 1900s and was characterized by a rigorous and systematic approach to surgical education.

The Halstedian model of surgical training emphasizes a “see one, do one, teach one” approach. This means that surgical trainees are expected to observe a procedure being performed, then practice the procedure under supervision, and eventually teach the procedure to other trainees.

In addition, the Halstedian model places a strong emphasis on the importance of surgical anatomy, meticulous technique, and careful attention to detail. Surgeons are trained to approach surgical procedures in a stepwise, methodical manner, with a focus on minimizing tissue trauma and achieving the best possible outcomes for the patient.

While the Halstedian approach to surgical training has been widely influential, it has also been criticized for being overly focused on technical proficiency at the expense of other important aspects of surgical practice, such as communication skills and patient-centered care. In recent years, there has been a movement towards more holistic approaches to surgical education that take into account the many different skills and competencies required to be a successful surgeon.

The purpose of neurosurgical education is to teach the clinical knowledge and surgical skills necessary to become a neurosurgeon. Another goal is to inculcate the principles of the scientific method.

Despite the advent of evidence based medicine, clinical pearls, verbal and published, remain a popular and important part of medical education.

However, increasing expectations about attending involvement during surgery, duty hour requirements, and new curricular mandates have put programs under stress to ensure adequate training, in less time, in an environment of limited resident independence. More recently, the Accreditation Council for Graduate Medical Education has developed a new tracking process based on “milestones” or defined educational outcomes. At the same time, our healthcare system is undergoing a rapid socioeconomic transition in organization and payment models, which traditionally has not been a focus of formal teaching. A 2008 survey conducted by the Council of State

Neurosurgical Societies found that graduating residents felt inadequately prepared in areas like contract negotiation, practice evaluation, and management [4].

Surgical education is moving rapidly to the use of simulation for technical training of residents and maintenance or upgrading of surgical skills in clinical practice. To optimize the learning exercise, it is essential that both visual and haptic cues are presented to best present a real-world experience. Many systems attempt to achieve this goal through a total virtual interface.

Bova et al., approach has been to create a mixed-reality system consisting of a physical and a virtual component. A physical model of the head or spine is created with a 3-dimensional printer using deidentified patient data. The model is linked to a virtual radiographic system or an image guidance platform. A variety of surgical challenges can be presented in which the trainee must use the same anatomic and radiographic references required during actual surgical procedures.

Using the aforementioned techniques, they have created simulators for ventriculostomy, percutaneous stereotactic lesion procedure for trigeminal neuralgia, and spinal instrumentation. The design and implementation of these platforms are presented.

The system has provided the residents an opportunity to understand and appreciate the complex 3-dimensional anatomy of the 3 neurosurgical procedures simulated. The systems have also provided an opportunity to break procedures down into critical segments, allowing the user to concentrate on specific areas of deficiency [5].

see Neurosurgical Training.

Medical education

see Competency based medical education

see Continuing medical education

Neurosurgery Education and Research Virtual Group

Koller et al. reviewed virtual research initiatives for early trainees in neurosurgery and describe the effort to expand access to resources and shared objective mentorship (SOM) via the novel Neurosurgery Education and Research Virtual Group (NERVE).

Methods: A systematic review of neurosurgical programming delivered via a virtual platform was conducted using PubMed, Embase, and Scopus databases. Identified articles were screened. Those meeting pre-specified inclusion criteria were reviewed in full and examined for relevant data. Data analysis was performed using Microsoft Excel, and means and standard deviations were calculated. A descriptive analysis of NERVE characteristics was also performed.

Results: Of the 2,438 identified articles, ten were included. The most common (70%) implementation style was a webinar-based lecture series. The least common (10%) was a longitudinal curricular interest group. Of the total NERVE cohort, 90% were first-generation medical students and 82% attended institutions without home programs. Survey results indicated 73.8% had contributed to at least two research projects throughout the year.

There is a scarcity of virtual neurosurgical resources which facilitate SOM opportunities for trainees. In a systematic review, NERVE is the only multi-institutional virtual initiative aimed at increasing access to neurosurgical education and research opportunities for the purpose of SOM among early trainees from disadvantaged backgrounds. This highlights the group's niche and potential impact on increasing diversity in neurosurgery, improving trainees' career development, and facilitating future resident research productivity [6].

ChatGPT for Neurosurgical education

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