

Letter: The impact of COVID-19 on International Neurosurgical Electives

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Manuscript:

Dear editor,

Neurosurgery is one of the most competitive specialties in the US and UK.^{1,2} Thus, medical students must be highly engaged and productive during their preclinical and clinical years to build strong residency applications. At most institutions, formal exposure to neurosurgery during medical school is weighted toward the senior years, and it is often the student's responsibility to explore the field during earlier years.³

COVID-19 has fundamentally changed the way neurosurgery is practiced, learned, and taught across the globe. With the spread of the pandemic, visiting elective neurosurgical programs were canceled.⁴ Between 75% to 100% of student electives were canceled in 2020 alone, and in 2021,⁵⁻⁷ most were either restricted to limited travel electives or none at all.⁸

International neurosurgical electives (INE) are an integral part of neurosurgical education and are popular among aspiring neurosurgeons.⁹ They allow students to experience neurosurgery in different healthcare settings and cultivate interest. INEs improve clinical examination skills, decrease dependence on expensive technology, increase exposure to certain diseases and pathologies encountered more frequently in specific institutions, and enhance cross-cultural understanding.⁸

In this letter, we examine the reported effects of COVID-19 on INEs and suggest solutions to counter this most effectively.

The Impact of COVID-19 on the rates of INEs

In a recent survey of aspiring neurosurgeons in the US, 26.8% of students reported cancellation of INEs, whereas 26.0% of students reported cancellation of home neurosurgical sub-internships and electives.¹⁰ Thus, among the COVID-19 related changes to medical students' clinical experiences, the cancellation or postponement

of neurosurgical sub-internships might have the greatest effect on neurosurgical applicants. Without sub-internships, students will lose opportunities to obtain letters of recommendation (LORs), gauge the cultural differences among the neurosurgical training programs, and demonstrate their character and competence in clinical and operation room (OR) settings.

In German-speaking countries (Germany, Austria & Switzerland), a study¹¹ examining the two largest elective reports databases to investigate how the COVID-19 pandemic affected INEs confirmed the negative impact of COVID-19 on INEs.¹¹

The way forward

Virtual learning is a useful adjuvant to clinical education. Virtual grand rounds and teleconferences have supplemented surgical clerkships and electives during the pandemic. They facilitate discussion of clinical cases, improve presentation skills, and favor networking with residents, faculty, and fellow applicants.

The Congress of Neurological Surgeons has provided virtual learning in the form of online grand rounds and virtual visiting professor lectures that provide 2–3 hour weekly lectures. These lectures have been widely attended and a summary analysis of social media comments shows that they have been very successful. Many US neurosurgical departments transitioned swiftly to offer virtual sub-internships, such as those organized by Mount Sinai and Ohio State University. These virtual experiences offer extensive teaching in clinical neuroscience, research opportunities, presentations as well as LORs.

Critics of virtual electives point to the fact that they lack hands-on experience, patient communication, and clinical examination skills. Innovations such as the use of virtual and augmented reality, live streaming rounds from the hospital, and virtual patient interactions can be used to remotely educate students while offering some hands-on experience. For example, virtual reality courses given via BrainBoxes provide fundamental hands-on experiences, simulating real-life scenarios.^{12–14} These hybrid training simulation BrainBoxes have made neurosurgical training far more accessible to residents and keen undergraduates. Furthermore, the medical student neurosurgery training center (MSNTC) provides both hands-on and web-based neurosurgical education to medical students around the world without economic, institutional, or geographic barriers.¹⁵ MSNTC offers virtual training camps, which consist of a one-day intensive course in neurosurgery.

Throughout these difficult times, undergraduates can maintain academic momentum by adapting strategies to mitigate the loss of opportunities and subsequent potential skills to develop a neurosurgical portfolio. These strategies (table 1) could include the utilization of telerotations, tele-research experience, and the development of tools to facilitate the safe return of undergraduates to neurosurgical electives.

Undergraduates who were unsuccessful in securing hands-on or even virtual electives can benefit tremendously from virtual research electives. Virtual research was developed to fulfill the same core objectives as a traditional in-person summer experience. Li et al. recently outlined in *Cell* the key objectives for an undergraduate training program: “developing technical skills, gaining a broad understanding of the field, learning research rationale and key methodology, designing and managing

projects, and improving effective scientific communication.”¹⁶ With labs shuttered, hands-on experimental instruction seems impossible, yet we can determine that the remaining objectives could be adapted for a virtual setting. Guided by experienced mentors over video chat, research trainees can learn to read and critically assess scientific literature—an increasingly relevant skillset. Trainees can also familiarise themselves with digital lab and statistical tools.

Table 1. Recommendations and possible solutions for lost opportunities amongst undergraduates on “How to enhance and develop a neurosurgical portfolio during COVID-19?”	
Virtual electives	<ol style="list-style-type: none"> 1. Virtual electives offer a valuable experience as they cultivate undergraduates’ interests, though they do not compensate for hands-on electives. In other specialties, they have been well received. However, there is no evidence of their efficacy in neurosurgery, specifically. 2. Electives often prompt an association with a center, and subsequent connections can lead to research and publications, which are unequivocally useful to applications.
Virtual research experience and participation in e-conferences	<ol style="list-style-type: none"> 1. Some centers offer tele-research experience or virtual research programs, which have been well received so far. This may ameliorate the problems but are restricted to projects only possible to be undertaken virtually, and many are disadvantaged from this, especially those from LMIC countries. 2. E-conferences provide opportunities to make connections worldwide, and develop existing neurosurgical interests, without necessitating travel. 3. The American Association of American Medical Colleges has put together summer Undergraduate Research Programs (https://www.aamc.org/professional-development/affinity-groups/great/summer-undergrad-research-programs)
Risk assessment tools	Another option is facilitating the ease of access to electives for undergraduates, by developing risk assessment tools. This is promising. However, the effect may be heterogeneous depending on the covid state for each country/institution, and their respective stages in the pandemic, which may make developing ubiquitous tools difficult.
No detriment policy for upcoming applicants	For those that had secured offers to partake in an elective before the pandemic, this could be considered, or the applicant not marked down for not having an elective altogether. At the extreme, electives could be removed from the scoring matrix for all applicants, although this would have the largest ramifications.
Joining a neurosurgery interest group	<ol style="list-style-type: none"> 1. Global NeuroSurgery 2. Association of Future African Neurosurgeons (AFAN) 3. Neurology And Neurosurgery Special Interest Group (NANSIG) 4. Medical student neurosurgery training center (MSNTC)
Virtual mentorship programs	<ol style="list-style-type: none"> 1. InterSurgeon 2. NANSIG’s Mentorship’s scheme 3. AANS mentorship Program

Conclusion

A virtual neurosurgery elective will never be able to fully compensate for the lack of face-to-face clinical exposure to seeing patients and the overall medical environment, as well as being present in the operating room. However, the current pandemic will

assuredly see an end, and the lessons learned may inform changes to clinical education well beyond the era of social distancing.

Long before the pandemic, the benefits of in-person versus online didactic lectures have been arenas of debate, without conclusive evidence to date with regards to neurosurgical training. The convenience provided by virtual conferencing may save transit time for countless faculty, students, and residents, and the ability for students to join faculty via telemedicine clinic may enable more consistent interaction between the two.

We believe the lack of neurosurgical elective opportunities should be considered in neurosurgery residency applications moving forward, and institutions should embrace all available options listed above, to help ameliorate this issue as much as possible.

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