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Letter to the Editor

Letter to the editor: The use of workshops and courses in microneurosurgery training in low- and middle-income countries (LMICs) with a Latin American and Peruvian perspective

Martha I. Vilca-Salas[1], Carlos Cabrera-Cruzado[2], Wagner Rios-Garcia[3], Ariana A. Alvarez-Rojas[1], Mayra Ximena Uscamayta-Cabrera[1], Jason Riveros-Ruiz[4]

[1]School of Medicine, Universidad Peruana Cayetano Heredia, Lima, [2]Sociedad Científica de Estudiantes de Medicina de la Universidad Nacional de Trujilla, Nacional University of Trujillo, Trujillo, [3]Sociedad Científica de Estudiantes de Medicina de Ica, Universidad Nacional San Luis Gonzaga, Ica, [4]Department of Neurosurgery, Hospital Nacional Daniel Alcides Carrión, Bellavista, Lima, Peru.

E-mail: *Martha I. Vilca-Salas - martha.vilca@upch.pe; Carlos Cabrera-Cruzado - ccabrerac@unitru.edu.pe; Wagner Rios-Garcia - wagner16rg@gmail.com; Ariana A. Alvarez-Rojas - ariana.alvarez@upch.pe; Mayra Ximena Uscamayta-Cabrera - mayra.uscamayta@upch.pe; Jason Riveros-Ruiz - jasonwr1013@gmail.com

***Corresponding author:**
Martha I. Vilca-Salas,
School of Medicine,
Universidad Peruana Cayetano Heredia, Lima, Peru.

vilca@upch.pe

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Dear Sir,

Education in neurosurgical skills is essential for training neurosurgeons and neurosurgery residents, and it is primarily acquired through operating room experience. However, it is necessary to supplement this training with workshops and courses in micro neurosurgery that involve cadaveric dissections, the use of surgical simulators, and synthetic models, among other methods.[4] In low- and middle-income countries (LMICs) like Peru, the development of these training activities is limited. This article aims to report some of the experiences in using micro neurosurgery workshops and courses conducted in LMICs, including Peru.

NEUROSURGICAL TRAINING WORLDWIDE

In more developed countries, the implementation of these workshops is more feasible due to their greater resources and accessibility. For example, in Spain, the 3D Neuroanatomy project was developed by the neurosurgery department of the General University Hospital of Alicante. This project focuses on creating three-dimensional cinematic presentations of neuroanatomical dissections and offers workshops with various neurosurgical approaches. They also have a digital platform (available at www.3dneuroanatomy.com) where they broadcast course lectures and provide different chapters on neurosurgical approaches.

The situation differs in LMICs, where economic, technical, and bureaucratic limitations often prevent frequent workshops. In response to this, some LMICs receive support from organizations like the World Federation of Neurosurgical Societies through corporations like UpSurgeOn, a nonprofit project (available at: https://www.upsurgeon.com/) that provides training workshops with virtual reality models and hyper-realistic brains to countries like Iraq.[1] Similarly, organizations like Mission: Brain, with the support of UpSurgeOn, offer the opportunity to bring neurosurgical models to countries where the project is being developed, and chapters of the organization can

apply for this opportunity for free.[8] Simultaneously, some LMICs are trying to develop autonomous ways of providing neurosurgical training, using stereomicroscopes and everyday objects such as latex gloves, chicken wings, and more for practicing micro sutures and micro anastomosis skills.[2]

Establishing private academic centers that organize neurosurgical workshops is equally important, as seen in countries such as Egypt, Morocco, South Africa, and Cote d'Ivoire, where private training centers for micro neurosurgery with cadavers exist.[7]

NEUROSURGICAL TRAINING IN LATIN AMERICA

We can highlight advances in developing micro neurosurgical workshops and courses in Latin America. In Mexico, as part of their pre-congress course before the Mexican Congress of Neurological Surgery in 2023 (organized by the Mexican Society of Neurological Surgery), a workshop using anatomical cadaveric models was held in a surgical laboratory available in the country. The 2023 Mexican Congress of Neurological Surgery also included a microsurgery workshop.[12] In Argentina, micro neurosurgery and neuroendoscopy courses have been incorporated into the Neurosurgery residency program, particularly in the 4th year of the specialty.[5] In addition, workshops and courses on surgical neuroanatomy and microsurgery are conducted by doctors Alvaro Campero and Matias Baldoncini, who are even invited as international speakers in other countries in the region. In Brazil, Dr. Feres Chaddad Neto provides courses in microsurgical neurosurgery and is invited to conduct national and international virtual courses or workshops for neurosurgeons, neurosurgery residents, and medical students. We also highlight the work of Dr. Evandro de Oliveira, who founded the "Prof. Dr. Evandro de Oliveira" microsurgery laboratory in 1993,[6] providing training and development opportunities for Brazilian and Latin American doctors through continuous education courses [Table 1].

Table 1: Examples of some microneurosurgery laboratories in Latin America.

Country	Microneurosurgery laboratories
Argentina	Neurologic Microsurgery Lab at Hospital de Clínicas "José de San Martín" Microsurgical Neuroanatomy Lab (LaNeMic), Segunda Cátedra de Anatomía, Universidad de Buenos Aires Microsurgery Lab, Universidad Nacional de La Plata
Brazil	Neurologic Microsurgery Lab, Escuela Paulista de Medicina, Universidad de Sao Paulo, Brasil Dr. Evandro de Oliveira Microsurgery Lab, Beneficência Portuguesa Hospital, São Paulo
Mexico	Surgical Skills Center, Naucalpan
Colombia	Microsurgery Lab, Instituto de Neurociencias, Universidad El Bosque

NEUROSURGICAL TRAINING IN PERU

The main challenge in implementing micro neurosurgery workshops and courses in Peru lies in the costs associated with acquiring suitable facilities, state-of-the-art equipment, specialized surgical materials, and anatomical specimens of proper quality and preservation. Despite these limitations, some small advancements have been made in recent years in incorporating microneurosurgery training into residency programs. The first neurosurgical training center in Peru is located at the *Instituto Nacional del Niño de San Borja*, where several courses are offered in various specialties, including neurosurgery. In addition, the *Universidad Nacional Mayor de San Marcos* has included a course in microsurgical techniques in the 5th year of the neurosurgery-specialty curriculum, which is conducted at the previously mentioned center. Another progress was the establishment of neurosurgical practice workshops in the first high-specialty neurosurgical center at the EsSalud Hospital located in Trujillo, Peru, in 2014, with the collaboration of doctors from Finland and Japan.[3] A more recent case occurred in Lima, Peru, with the creation of the first neuro microsurgery and 3D printing laboratory at the *Hospital Central de Policía* "*Luis N. Sáenz*" in 2022, developed through a collaboration between the Barrow Neurological Institute and the Peruvian Society of Neurosurgery.[9] Unfortunately, all these workshops could not be consistently integrated into the training of residents and neurosurgeons because they were not established in any residency program's curriculum in the country.

Aside from international collaboration, in Peru, the organization of neurosurgery workshops and courses largely depends on the university that oversees the residency program in question and the resources it manages. As an example of this, neurosurgery residents at the Universidad Peruana Cayetano Heredia program have the opportunity to participate in workshops using UpSurgeon's virtual reality equipment, making it the first Peruvian residency program to offer a simulation center aimed at training aspiring neurosurgeons.[10]

CONCLUSION

Interest in training in this field is growing worldwide and should serve as a call to action for neurosurgery residency programs, especially in LMIC environments. The goal is to promote the education of neurosurgery residents through procedure simulation and the enhancement of their manual dexterity. This can be achieved by exchanging experiences between national and international professionals searching for cost-effective options for simulating neurosurgical practice, support from international organizations, and fundraising.

Likewise, a micro neurosurgical training program maximizes the potential for learning these types of surgeries by providing a better understanding of surgical approaches and enhancing residents' self-esteem and surgical skills. Beyond the ability to learn more in less time and transfer acquired knowledge from a laboratory to an operating room, it reduces the stressful environment of a real operating room and the potential legal issues by minimizing the risk of harm to patients.[11]

The key to fostering the development of micro neurosurgery workshops and courses lies in organizing them as part of a formal training program or incorporating them into the residency program curriculum; this would ensure that training is continuous rather than sporadic.

Ethical approval

Institutional Review Board approval is not required.

Declaration of patient consent

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Conflicts of interest

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