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Academic neurosurgery in Nepal: Present status and future directions

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ABSTRACT

Introduction: The establishment of local neurosurgery training programs in Nepal has proven critical for the expansion of the discipline across the country. This paper aims to describe the evolution, current status, challenges, and future directions of academic neurosurgery in Nepal.
Research question: What is the current status and international standing of academic neurosurgery in Nepal?
Material and methods: Information related to growth and development in Nepal was obtained from universities and regulatory bodies in Nepal. Variables described are the current number of neurosurgeons, the number of neurosurgical centers and centers with accreditation for training, the description of existing training models, the number of graduates, and the contribution of Nepalese neurosurgeons to world literature.
Results: Formal neurosurgical training started in Nepal in 1999. Of 67 hospitals with neurosurgical facilities, 10 (14.9%) are accredited. Three training models (MCh, NBMS, and FCPS) currently exist. Of 116 neurosurgeons currently practicing in the country, 47 (40.5%) are homegrown. The contribution of the Nepalese neurosurgical community to the world includes the training of the first two Maldivian neurosurgeons and an increasing presence in world neurosurgical literature.
Conclusions: Although comparable to other countries with similar economies, Nepal still faces some challenges to the sustainability and further developments of Neurosurgery. Continued concerted efforts will help Nepalese neurosurgeons achieve the goal of securing self-reliance in neurosurgical education.

1. Introduction

Nepal is a landlocked lower-middle-income country (LMIC) located in South Asia with a 30 million population. Over the last three decades, significant progress has been noted in the healthcare sector. These are evident as: life expectancy at birth has increased from 56 years in 1990 to 69 years in 2020, childhood mortality has dropped from 140 per 1000 live births in 1980 to 24 in 2022, and the maternal mortality ratio has decreased from 539 per 100,000 live births in 1996 to 186 in 2017 (Central Bureau of Statistics, 2023; Mortality rate, 2023). Though contributions to these gains are certainly multifactorial, the continued development of academic healthcare infrastructure is undoubtedly a critical component of sustaining upward trends in health metrics.

This is a firsthand account of the development timeline and current status of academic neurosurgery in Nepal. We intend to describe the numerous challenges and successes, as similar issues may be encountered in other LMICs who are building a neurosurgical workforce. As in most LMICs, Nepalese neurosurgery has a young history. Although the first neurosurgical procedure was performed by Professor D.N. Gongol in 1962, neurosurgery, as a surgical formal discipline, only began in 1989 with the return of Dr. Upendra P. Devkota after training in the UK. Here we will review the training models for neurosurgeons and highlight the growth and development of Nepalese academic neurosurgery.

2. Materials and methods

For this paper, publicly available information from relevant organizations (Nepalese Society of Neurosurgeons), Nepal Medical Council, Medical Education Commission, Tribhuvan University, National

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Abbreviations used in this paper

CT	Computed tomography
CPSP	College of Surgeons and Physicians of Pakistan
FCPS	Fellow of the College of Physicians and Surgeons
HIC	High-income country
LMIC	Low- and middle-income country
MCh	Magister chirurgiae
MRI	Magnetic resonance imaging
NBMS	National board of medical specialties
NESON	Nepalese Society of Neurosurgeons

Academy of Medical Sciences, Kathmandu University, and medical colleges from Nepal was obtained. For additional information, oral interviews were carried out with the medical leadership of these organizations. The current status of the neurosurgical workforce, the number of neurosurgical centers in Nepal, the number and geographical distribution of centers that provide accredited training and their academic profiles, types, and descriptions of different training models, and the number of graduates from Nepal were reviewed. In addition, the contribution of Nepalese neurosurgeons to world literature is discussed.

As this is a descriptive study of the growth and development of neurosurgery in Nepal, no attempt has been made to analyze the variables statistically.

3. Results

3.1. Training models

There are currently three training models in Nepal. In all models, the training is regularly monitored, with a final exit examination.

3.1.1. Magister Chirurgiae (MCh)

Magister Chirurgiae (MCh) was the first type of program in Nepal and it remains the favored training model to date. It is considered equivalent to PhD by universities in Nepal. A minimum of three faculty members (one professor, one associate professor, and one assistant professor/lecturer) must be on faculty before a center is allowed to initiate an MCh program. Following a three-year general surgery residency, MCh is a three-year neurosurgery residency. Trainees rotate in different subspecialty units, thus obtaining a broad range of skills. Publication of at least one peer-reviewed journal article and presentation of a thesis on a neurosurgery-related topic are the prerequisites for completion. The final summative exam (both theoretical and practical) is conducted by examiners from other institutions or countries. Only after passing the exam, the individual can apply for licensure to practice neurosurgery.

The positive aspects of this model are its familiarity both in Nepal and India, and its structured nature of training with a university affiliation. Unfortunately, the prerequisite of a mandatory general surgery residency before accessing neurosurgical training remains a significant barrier to medical graduates who would aspire to become neurosurgeons. Moreover, a mandatory 2-year period of required service in government hospitals must be completed before they can apply for neurosurgery training. This lengthens the overall training period. For these reasons, achieving neurosurgical certification often occurs above the age of 35. Another challenge is the short duration of the core neurosurgical training. As neurosurgical content is expanding exponentially, three years of exposure may not be adequate.

The first MCh program was started at Bir Hospital in 1999. Institute of Medicine under Tribhuvan University, National Academy of Medical Sciences, and two colleges under Kathmandu University currently offer this degree. As of December 2022, Nepal has produced 42 MCh graduates. The first two Maldivian neurosurgeons have also trained in Nepal (the first in 2015 and the second in 2022) within these programs. Currently, there are 16 MCh trainees in the country.

3.1.1.1. Fellow of the College of Physicians and Surgeons (FCPS).

Fellow of the College of Physicians and Surgeons (FCPS) is a fellowship program supported by the College of Surgeons and Physicians of Pakistan (CPSP), that accredits the centers in Nepal based on their operative volume, infrastructure, and availability of a senior tutor.

Established in 2003, FCPS is a 5-year program with two-year rotation in general surgery (Ali et al., 2021a). A mandatory thesis is followed by a final exam in Pakistan. The positive aspect of this program is that candidates are eligible to enter right after MBBS. Its potential drawback is obtaining training in one country and getting a degree from another.

Seven FCPS graduates have so far been trained in Nepal. Currently, there are 10 trainees.

3.1.2. Fellow of the National Board of Medical Specialties (NBMS)

Fellow of the National Board of Medical Specialties (NBMS) is the new type of degree proposed in 2021 to involve hospitals not affiliated with academic institutions/universities in neurosurgical training. A minimum of 100-bed hospital capacity, availability of in-house magnetic resonance imaging (MRI) and computed tomography (CT), and at least 400 operative neurosurgical cases per year are the accreditation criteria (similar to those for MCh). Currently, two centers offer this degree in Nepal. However, this program is yet to attract candidates, possibly due to some uncertainty in the nature of training and the unfamiliar name of the degree.

Nepalese training programs have been able to produce 49 neurosurgical graduates to date (including two Maldivians). It is gratifying to note that of the 116 neurosurgeons in the country, 47 (40.5%) are locally trained.

3.2. Training centers

Of 67 hospitals where the neurosurgery service exists (defined as the presence of at least one full-time neurosurgeon with facilities such as the availability of anesthesiologist(s), surgical instruments, and post-operative care for cranial and spinal surgery), 10 are accredited for neurosurgical training. Fig. 1 depicts the available neurosurgical centers and centers accredited for training in Nepal.

3.3. Regulatory bodies

3.3.1. Nepal medical council

Nepal Medical Council- Established in 1963, this body has the task of registering neurosurgeons as specialists before they can practice

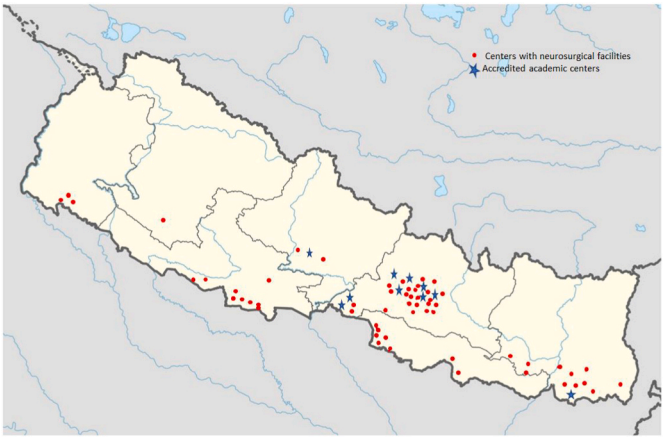

Fig. 1. Total neurosurgical centers and centers accredited for neurosurgical training in Nepal.

neurosurgery in the country. Obtaining continuous professional development points is encouraged, yet credits are not mandatory.

3.3.2. Medical Education Commission

Medical Education Commission- Established in 2017, it has overall strategic responsibility for academic neurosurgical matters in Nepal. It is vested with the immense power of designing/modifying the curriculum and taking entrance exams. It also regulates the accreditation of training centers.

3.3.3. Nepalese Society of Neurosurgeons (NESON)

Nepalese Society of Neurosurgeons (NESON)- Founded in 2007, it is not a regulatory body in the strict sense. However, society promotes neurosurgical activities and research. International and national conferences as well as educational courses (both symposiums and hands-on) are regularly organized. Neurovascular and spine chapters under NESON are actively engaged in promoting their subspecialty interests.

3.4. International standing

Neurosurgical training programs are growing rapidly in Asia. Addressing the deficit in the neurosurgical workforce has been the main driving force for academic neurosurgery. There are similarities and differences in neurosurgical education in different parts of the world (Kato et al., 2020; GASCO, 2014). Table 1 depicts the establishment of neurosurgical academic centers and their output in neighboring countries and Nepal. Of the countries listed Bangladesh, India, Myanmar, Pakistan, and Sri Lanka are LMICs while China and Malaysia are upper-middle-income countries (WDI, 2023). As the sources for this data are from different years and some information is not available, it is not possible to perform an adequate head-to-head comparison.

3.5. Current status of neurosurgery in Nepal

Nepalese neurosurgery has now reached a stage comparable to that in neighboring countries with similar economies (WDI, 2023). Fig. 2 shows the growth of neurosurgeons over time. In 1989 there was only one neurosurgeon per 19.1 million people, whereas, by the end of 2022, there were 116 neurosurgeons for 29.9 million people.

As shown in Fig. 2 the main challenge in the first two decades of Nepalese Neurosurgery was the critically low number of neurosurgeons which improved drastically after 2009. The big leap in Nepalese neurosurgery both in terms of manpower and technology (modern imaging, neuronavigation, operative microscopes, and surgical robotics) was facilitated by the establishment of a local training program in 1999. Moreover, many international neurosurgery residents and medical students from Germany, Bangladesh, the UK, the USA, Switzerland, Japan, etc. do electives in neurosurgery in Nepal. Though there is still a lot of room to improve, its status is significantly better today and no patient needs a referral abroad for treatment (Table 2).

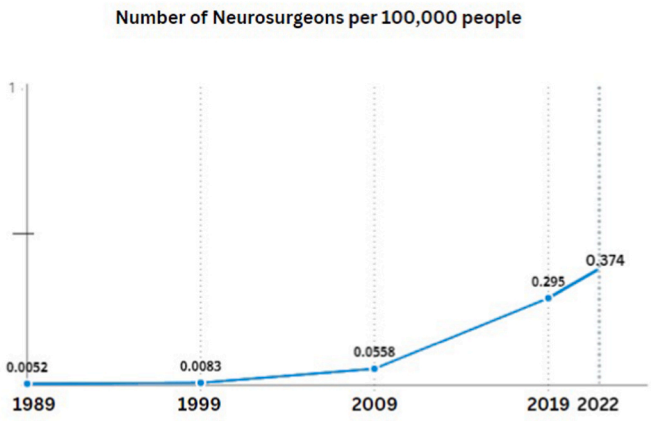

Fig. 2. The trend in the neurosurgeon-to-population ratio from 1989 to 2022.

3.6. Contribution of Nepalese neurosurgeons to the world literature

The first neurosurgical publication from Nepal was by Prof. DN Gongol in 1980 (Gongal, 1980). However, Nepalese publications were rare until the Nepal Journal of Neuroscience was launched in 2004 with Mohan R. Sharma as founding Editor-In-Chief. This is the official journal of NESON and serves as a forum for publication by neurosurgeons and allied health professionals both in Nepal and abroad.

In the last two decades, Nepalese publications have increased in the world literature despite having a less than optimal neurosurgeon-to-population ratio (0.38 per 100 000 population) (Kato et al., 2020). Our PubMed search of data from 2001 to 2022 revealed 290 articles related to Neurosurgery from Nepal. As shown in Table 3, the primary authors of 125 articles were Nepalese neurosurgeons. The increasing number of accredited centers and the mandatory thesis writing and publication nature of Nepalese training have been the main driving forces behind the improvement of publication output from Nepal. However, a discrepancy among the neurosurgical centers regarding output is still evident. Nepal has already been part of some international multi-center trials (CRASH-3 trial collaborators, 2019; Robba et al., 2023). Its participation in clinical trials is likely to increase in the future thanks to international collaboration and funding.

4. Discussion

As in other LMICs, the establishment of local training programs has served as a quantum leap forward for neurosurgery in Nepal. These gains

Table 1
Comparison of the establishment of neurosurgery education and related parameters in neighboring countries and Nepal.

Country	Beginning of local training program	Number of training centers	Number of homegrown graduates	Current number in training
China[a]	1953	100		2000
India[b]	1958	120		482 (annual intake)
Sri Lanka[c]	1979	3		
Pakistan[d]	1989	22		177
Bagladesh[e]	1997	4	140	89
Myanmar[f]	2016	3	16	36
Malaysia[g]	1995	5	78	53
Nepal	1999	10	45	26

[a] Reference (Feng, 2015).
[b] Reference (Kato et al., 2020; Nanda and Sonig, 2013; Sarpong et al., 2022; Chaganty et al., 2021).
[c] Reference (Kato et al., 2020).
[d] Reference (Ali et al., 2021a, 2021b).
[e] Reference (Kato et al., 2020; Khan et al., 2019).
[f] Reference (Kato et al., 2020).
[g] Reference (Abdullah et al., 2021; Ferraris et al., 2020).

Table 2
Current status and facilities related to Neurosurgery service in Nepal.

Parameters	Number
Total number of neurosurgeons currently working in Nepal	116
Total number of CT scans	95
Total number of MRIs	40
Centers with operating microscopes	40
Centers with critical care specialists' service	7
Centers with neuronavigation	5
Centers with intraop CT/O arm	3
Centers with intraop MRI	1

CT = Computed tomography, MRI = Magnetic resonance imaging.

Table 3
Bibliometric parameters on publications related to neurosurgery in Nepal (n = 290).

Parameters	Number
Nepalese neurosurgeon as primary authors Nepalese Neurosurgeon	125
contributing as co-author in an article written by other international authors	84
Articles written by Nepalese non-neurosurgeons)	30
Articles written by Nepalese non-neurosurgeons with Nepalese neurosurgeon(s) as co-authors	34
Expatriate neurosurgeons contributing as first authors	17

offer the possibility of an increasingly specialized workforce and a progressively larger network of neurosurgical centers.

At present, both in LMICs and high-income countries (HICs), a neurosurgeon is valued more for their clinical output than the contribution to medical education (Couldwell et al., 2014). However, this paradigm is extremely detrimental as it might jeopardize the future of neurosurgery, especially in LMICs. One active neurosurgeon is estimated to perform approximately 245 cases per year (Dewan et al., 2018), reaching the target of 7350 surgeries over a period of 30 working years. When the same surgeon also trains young professionals, the number of patients accessing this care will grow exponentially (Rajshekhar, 2018). This is the most compelling reason to promote academic centers in LMICs.

Although there is no consensus as to what constitutes an academic neurosurgeon, the most reliable metric is the direct involvement of the individual in the training of the next generation of surgeons (Staveley-O'Carroll et al., 2005; Dacey, 2018). This has been the basis of describing the evolution and current status of academic neurosurgery in Nepal. Academic neurosurgery needs to be active and vibrant in order to sustain and optimize the progress of our specialty. Pursuing an academic career offers the prestige associated with being a mentor, the academic rank at a reputed university or institute, the potential for international collaboration, and continued professional development (Burger et al., 2005; Mukherjee, 2009). Challenges faced by academic faculty include: a substantial time commitment to trainees, long clinical work hours, numerous competing priorities, and the need to maintain an ongoing activity in research and publications (Black, 2006; Irwin et al., 2014; Christmas et al., 2010). Particularly in LMICs, those who work in hybrid models (primary full-time appointments in academic medical centers, but also with a private practice in off-ours) often risk burnout. Moreover, the potential unavailability of resources for effective academic performance and limited research opportunities are amplified in LMICs (Kanmounye et al., 2022; Xu et al., 2016; Calderon et al., 2022; Wicaksono et al., 2020).

4.1. Challenges

There are several challenges ahead for academic neurosurgery in Nepal which can be generalized to other LMICs as well.

4.1.1. Creating a sustainable workforce

Typical of an LMIC, Nepal has a very unequal distribution of healthcare resources. Despite the fast increase in the number, Nepal still suffers from a shortage of neurosurgeons (estimated need of 300 based on the 1/100,000 criteria), and their uneven distribution (Fig. 1). In urban areas, patients can easily find modern resources such as modern imaging and neurosurgeons with microsurgical skills whereas, in the rural regions, they must travel many hours or days even to get basic neurosurgical care (SR255, 2023). A 2-h access window for basic surgical services for every household is advised by the Lancet Commission for sustainable development goals 2030 (Meara et al., 2015). Nepalese academic neurosurgeons have the obligation of pursuing the further implementation of their specialty to reach this goal.

In Nepal and the other LMICs, the serious threat of undersupply of academic physicians has to be identified and solutions must be provided. The main challenge is not only to produce more but also to create a working environment for recent graduates that prevents brain drain, a plague that affects many LMICs.

4.1.2. Restructuring of the traditional working environment

Working with different stakeholders (hospitals, medical schools, and ministries) to address the inadequate and uneven distribution of the workforce and building sustainable neurosurgery training programs might be viable solutions to address the workforce deficit. In this context, the role of academic neurosurgeons is undoubtedly crucial and the creation of more academic positions in neurosurgery is urgently required. Academic careers must be financially viable, socially desirable, and practically attainable. Departments must balance their time between clinical service and research. Protected time for faculty to pursue academic activities is recommended but not often practiced (Ali et al., 2021b; Khan et al., 2019; Rajshekhar, 2018; Christmas et al., 2010; Wicaksono et al., 2020). Recently accredited centers need strengthening in terms of manpower, surgical technology as well as adequate case volumes. Increasing access to funding and international collaboration will help gain momentum in the academic environment.

4.1.3. Attracting candidates in neurosurgery

A major problem that merits mention is the dearth of young professionals interested in pursuing a neurosurgical career. Although Nepal has been able to accredit an increasing number of training centers, the actual intake of trainees per year has dropped. This is reflected in the intake of only 5 candidates in 2022 when more than 14 seats were available (Research Degree (DM/MCh), 2023). Our recent study on the career choice of medical students showed that only about 24.0% of recent graduates aspired to become neurosurgeons (Parajuli et al., 2022). Pursuing a neurosurgical career was not appealing due to long working hours, a longer duration of training, and less than optimal private practice opportunities after graduation.

4.1.4. Restructuring the curriculum

A solution to trigger enthusiasm in the young graduates might be more neurosurgery exposure during undergraduate years (currently limited to a 2-week exposure during MBBS at Tribhuvan University) (Black, 2006). As previously mentioned, another barrier is the mandatory general surgery residency that is required before applying for neurosurgery. Following the global trend and that of India in particular, we should restructure the curriculum with an opportunity for direct entry after undergraduate training as general surgery and neurosurgery techniques are vastly different (Banerji, 2016; Ramesh, 2021). A five-year program with a one-year rotation in general surgery would be most appropriate in the Nepalese context. We have requested NESON and concerned universities and regulatory bodies for this change, and are hopeful that this will materialize soon. Allowing the newly accredited centers to start such direct programs while the existing centers phase out the older system as adopted in India will be an ideal immediate solution (Banerji, 2016).

4.1.5. Defining adequacy

We also need to define what is adequate training in the Nepalese context, although criteria might change with time and technological advancements. Participation in a certain number of surgical procedures by a trainee during residency is probably the best indicator. For example, in 2014, the Neurosurgical Society of India proposed training guidelines that included minimum participation in 400 operations with 10% of cases performed without the assistance of a senior (UNIFORM CURRICULUM FOR MCh AND, 2023). A syllabus describing a minimum quality standard is also required. Though technical competency can be assessed in the summative exams, ways to assess non-technical skills should also be formulated.

4.1.6. Challenges in research and publications

Research and publications are the least developed aspect of neurosurgery in LMICs as the specialty is very procedure-intensive (Chaganty et al., 2021; Ali et al., 2021b; Khan et al., 2019). The paradox is that while the opportunity for conducting research is abundant, the enthusiasm for it among physicians is low. The barriers to research include intense involvement in clinical care, no protected time for research, lack of funds, fewer role models, and less-than-ideal incentives for these translational investigators among others (Whiffin et al., 2021). There is an urgent need for creating national registries for trauma, stroke, and other common diseases of the nervous system.

4.2. Future directions

Challenges always come with opportunities. Academic neurosurgery has come of age in Nepal and is now 23 years old. Self-reliance with dedicated neurosurgical education and training is our ultimate goal. Graded, closely supervised training with adequate case volume is a must in neurosurgery. Hence, we need to accredit the neurosurgery training centers with adequate infrastructure, manpower, and volume in the future. Those who have all these should be encouraged to be accredited.

Next in our priority is the creation of better surgical skill training labs that will enhance the technical skills of our residents tremendously before they are directly involved with patients.

The concerns from the perspectives of patients and families should also be addressed. There is a general perception among the public that in academic centers, operations are largely done by trainees. Public awareness of the fact that the goal of these centers is to provide proper training without compromising patient care should be increased.

5. Conclusions

Establishing local training programs has proven invaluable to Nepal in creating the needed manpower and optimizing the progress of neurosurgery. Though initial progress was rather slow, the last two decades of development have shown some impressive results as evidenced by the increased number of homegrown neurosurgeons and academic publications. Self-reliance with dedicated neurosurgical education and training remains our priority. Continued concerted efforts will help the Nepalese neurosurgical community achieve its ultimate goal of securing self-reliance in education.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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