Historical perspective of Indian neurology

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Abstract

Objective: To chronicle the history of medicine and neurology in India with a focus on its establishment and evolution. **Background:** The history of neurology in India is divided into two periods: ancient and modern. The ancient period dates back to the mid-second millennium Before Christ (B.C.) during the creation of the Ayurvedic Indian system of Medicine, which detailed descriptions of neurological disorders called Vata Vyadhi. The early 20th century witnessed the birth of modern Indian medicine with the onset of formal physician training at the nation's first allopathic medical colleges located in Madras (1835), Calcutta (1835) and Mumbai (1848). Prior to India's independence from Britain in 1947, only 25 medical schools existed in the entire country. Today, there are over 355. In 1951, physicians across the field of neurology and neurosurgery united to create the Neurological Society of India (NSI). Four decades later in 1991, neurologists branched out to establish a separate organization called the Indian Academy of Neurology (IAN). **Design/Methods:** Information was gathered through literature review using PubMed, MD Consult, OVID, primary texts and research at various academic institutions in India. **Results:** Neurological disorders were first described in ancient India under Ayurveda. The transition to modern medicine occurred more recently through formal training at medical schools beginning in the 1930's. Early pioneers and founders of the NSI (1951) include Dr. Jacob Chandy, Dr. B Ramamurthi, Dr. S. T. Narasimhan and Dr. Baldev Singh. Later, Dr. J. S. Chopra, a prominent neurologist and visionary, recognized the need for primary centers of collaboration and subsequently established the IAN (1991). The future of Neurology in India is growing rapidly. Currently, there are 1100 practicing neurologists and more than 150 post-graduate trainees who join the ranks every year. As the number of neurologists rises across India, there is an increase in the amount of basic, clinical and epidemiological research being conducted across the country every day. **Conclusions:** The history of neurology in India roots back to its rich culture and tradition. Over time, there has been great structural and organizational evolution and the future of neurology in India appears to be bright. However, the number of neurologists and research in neurology needs to experience a significant growth in the future to ensure the best patient care.

Key Words

Ayurveda, dementia, Epilepsy, history, stroke

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Early History of Medicine: (2000 B.C. - 500 A.D.)

The history of Indian Medicine dates back to Vedic Age (around 1500 B.C.).[3] The first descriptions of medical disorders and their proposed treatments through herbal prescriptions are found in the *Atharvaveda* (Around 2000-1000 B.C.). *Atharvaveda* was one of the four original Vedas (sacred texts of the ancient India) and as with most contemporary medical literature, it discussed medicine in the realm of magical spells and exorcism of demons.[4] Later, around the middle of 1st millennium B.C. emerged the traditional Indian system of Medicine "*Ayurveda"* (literally meaning "the knowledge of life") with a more scientific approach towards medicine. Two popular Ayurvedic texts *Charaka Samhita* and *Sushruta Samhita* were composed respectively by *Charaka,* a physician and *Sushruta*, a surgeon around 6th century B.C. They defined the specific purpose of medicine to cure the sick, protect the healthy and prolong life. Furthermore, just like modern allopathic medicine, *Ayurveda* distinctly classified medical practice into kāyācikilsā (internal medicine), śalyacikilsā (surgery including anatomy), śālākyacikilsā (eye, ear, nose and throat diseases), kaumārabhṛtya (pediatrics), bhūtavidyā (spirit medicine), manasrogracikilsa 7(psychaitry), agada tantra (toxicology), rasāyana (science of rejuvenation) and vājīkarana (aphrodisiacs/ virility).[5] The Ayurvedic System of Medicine stresses the balance of three elemental energies or humors *Tridoshas* namely: Vāyu vāta (air and space – "wind"), pitta (fire and water – "bile") and kapha (water and earth – "phlegm"). A disturbance in this balance results in disease with its attendant ailments.[6] [Figures 1-6].

Neurological disorders are classified under humor -Vata rogas (diseases) in Ayurveda. Vata is the energy that moves

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Figure 1: Sushruta performing a surgery with his students

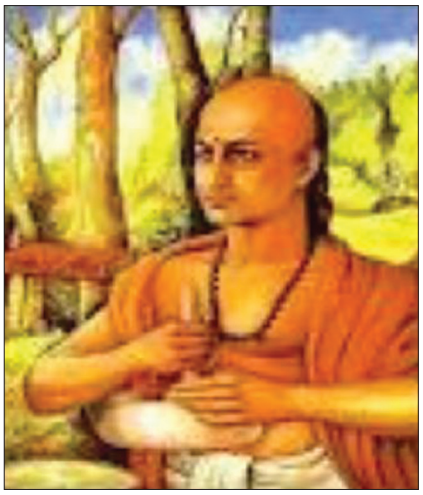

Figure 2: Charaka 500 B.C.

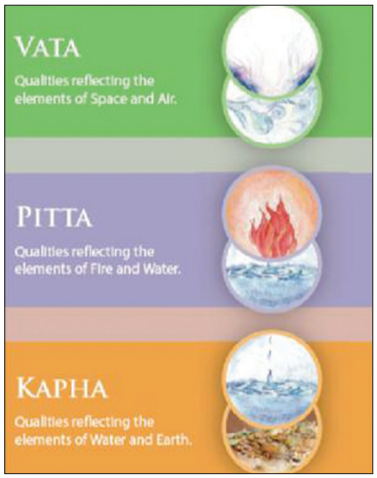

Figure 3: The 3 humors of Ayurveda

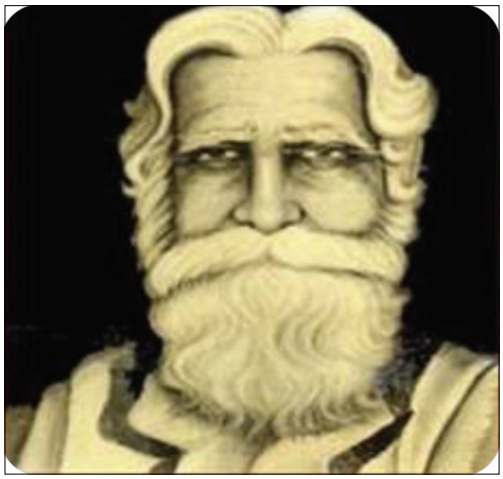

Figure 4: Sushruta

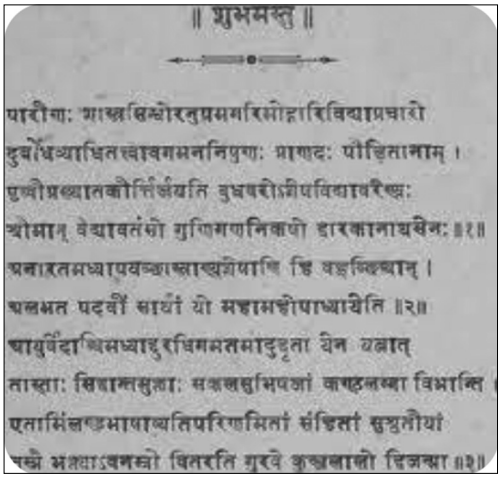

Figure 5: Sushruta Samhita

Figure 6: Charaka Samhita

throughout the body, including brain and thus controls both voluntary and involuntary functions. The pathogenesis of neurological disorders is due to deranged humor Vata which enters the tissues (dhatu) such as muscles (Mans), ligaments (Snayu), etc., The exacerbation or deficiency of this energy (vata) can cause disturbance in the form of hyperactivity or weakness of the nervous system. Within Ayurvedic texts, over 80 neurological disorders are described, including Apasmara/ Apasmrti (Epilepsy), Kampavata (Parkinson's Disease) and Shiroruk (Headache), Foot Drop (Paada Bhramsa), Numbness

in Feet (Paada Suptata), Sciatica (Gridhrasi), Loss of movement in thighs (Urusthambha) and Lameness (Pangu) Paraplegia, Wasting of arms, Brachial plexopathy (Baahu soshana), Tinnitus (Asabdasravanam), Temporal Headache (Shankha Bhedascha), Frontal Headache (Lalata Bhedascha), Bell's Palsy (Arditam), Monoplegia (Ekanga roga or vata), Quadreplegia/ Poly neuritis (Sarvangavata), Hemiplegia (Pakshavadha), Convulsions (Akshepaka vata), Syncope or Blackouts (Tamaha), Giddiness or Vertigo (Bhrama), Tremors (Vepathu), Hiccoughs (Hikka), Delirium (Atipralapa), Insomnia (Anidra), Instability of Mind (Anavasthita Chittam), Tetanus (Hanugrah) and Lathyrism (Kalay Khanj). For each category, a detailed clinical profile is presented and medical treatments are proposed.[7]

Medicine in Medieval India: 500 A.D. Until British Colonization of India (18th Century A.D.)

It is hard to comprehend how a system of medicine and treatment which reached great heights in ancient India, would over the course of centuries fade away gradually. Religious prejudices and rigidities led to the waning of the practice of Ayurveda. Although the practice of medicine flourished initially with the growth of medicinal and herbal farms and development of hospitals for both men and animals, it eventually suffered the same fate after being taken over by religious priests.[3] However, Ayurveda received a lot of encouragement during the Buddhist period roughly between 500 B.C. and 600 A.D. Buddhists propagated the knowledge of Ayurveda wherever their religion flourished until the twelfth century A.D. when the Mughals began their reign.[8] During the fifth and fourth centuries B.C., Ayurvedic physicians had an outstanding role at the University of Taxila in the Northwest India. Additionally, Ayurveda was taught in the renowned universities like Kashi and Nalanda. Jivaka, (544 B.C.-491 B.C.) an Ayurvedic physician and an expert in surgical techniques was the personal physician of Lord Buddha. Jivaka, like Sushruta, was a disciple of famous Ayurvedic doctor, Dhanvantari. Buddhist monks such as Nagarjuna and Vagbhata were Ayurvedic scholars who contributed a lot to the system.[9] Furthermore, Buddhist texts such as Bala Chikitsa (Paediatrics) promoted Ayurveda to greater limits. Many Buddhist texts speak about the three humors of Ayurveda and how they cause diseases. A Buddhist text called Saddharma-pundarika, widely known as the Lotus Sutra, describes various methods of administering drugs, using juices, infusions and medicinal decoctions. Vinaya Pitaka has references to the eight branches of Ayurveda. Melinda prasna, Maha Vagga and Chulla Vagga describe the principles of Ayurveda in detail.[9] Today, the practice of Ayurvedic medicine is preserved in various pockets of India, particularly in Kerala.

Around 1000 A.D. with the advent of Muslim invasions and the establishment of the Mughal Empire in India, the decline of Ayurveda became more rapid. The Mughals introduced their own *"Unani"* (Unani-tibb or Graeco-Arabic) system of medicine, which flourished until the arrival of Europeans in India.[3] When the Mongols ravaged Persian and Central Asian cities, scholars and physicians of Unani Medicine fled to India. The first Unani physician who came to India from Afghanistan (Herat) was Hakim Diya Uddin. The Delhi Sultan, the Khiljis, the Tughlaqs and the Mughal Emperors provided state patronage to the scholars and enrolled them as state employees and court physicians.[10] After this, these scholars conducted the study on Ayurvedic drugs and further enriched the contents of Unani. Soon, Unani became popular nationwide between 12th and 17th centuries and maintained a strong hold even after the downfall of Mughal Empire. During the British rule, Unani medicine suffered a setback and its development was hampered due to withdrawal of governmental patronage.[10] However, since Unani enjoyed faith among the masses it continued to be practiced. It was mainly the Sharifi Family in Delhi, the Azizi family in Lucknow and the Nizam of Hyderabad due to whose efforts Unani medicine survived during the British period.[10] Today, Unani medicine is patronized by the government of India with the establishment of 43 Unani colleges and 22 research institutes nationwide. Ministry of health and family welfare, which monitors health services in India has two major divisions: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy and Modern Medicine.

With the advent of 17th century, the Portuguese, Dutch, French and British East India Company came to India as traders. Each brought their own doctors for their workers on ships and in factories. Towards the middle of 18th century, the British defeated other colonizers in a series of battles and emerged as a dominant European force in India. As a result of this, they started conquering territories and colonizing from local Indian rulers, established armies and eventually took over the entire governance including medical services in the Indian subcontinent.[3]

Medicine in British India: (1858-1947)

Western Allopathic Medicine began in India when various acts such as the Quarantine Act (1825), Vaccination Act (1880), Birth and Death Registration Act (1896) and Epidemic Act (1897) were put in place. The British government established and organized Indian Medical Services to provide facilities for medical relief and the promotion of public health. The staff that occupied higher positions were recruited through examinations and trained in London.[11] The first medical colleges were established to help prepare staff who filled lower positions, in 1835 in Calcutta and Madras and in 1843 in Bombay [Figures 7-9].

Following the establishment of the first medical colleges, medical colleges were further established in Hyderabad (1846), Lahore (1860), Pune (1878) and Sindh (1881). Thereafter, in the early 1900s medical colleges were set up all over India to provide adequate training for upcoming medical professionals. Some of these colleges include: King George Medical College in Lucknow (1911), Medical College of Dhaka (1921) and the SMS Medical College Jaipur, India (1947). By the year 1946, there were 38 medical colleges with an estimate of 2,400 annual admissions in various parts of British India. In order to foresee medical education, the Medical Council of India was established in 1934. The Indian Medical Council was governed by the British Medical Council. British India saw great success, but India progressed at a rapid rate after gaining Independence.

Medicine in Post-Independence India: (1947- Current)

As India gained its Independence on Aug 15th in 1947, the medical field started to excel in every direction. By 1964, the

Figure 7: Calcutta Medical College, Kolkata (1835)

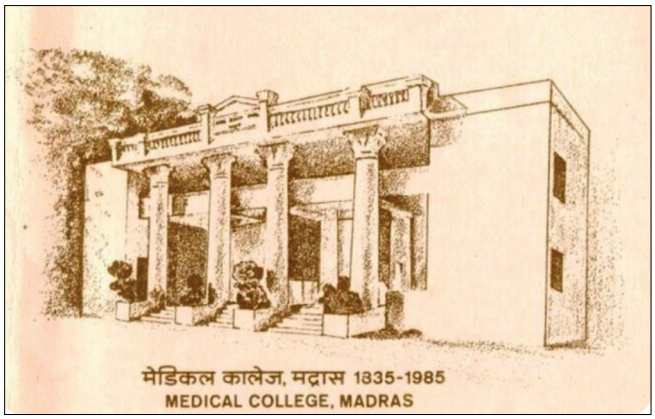

Figure 8: Stanley Medical College, Chennai (1835)

Figure 9: Grant Medical College, Mumbai

number of medical colleges reached 81 with over 10,000 annual admissions. The Central Government of India took upon the executive responsibility of developing postgraduate medical education and promoting special studies and research in medicine. The University Grant Commission was established in 1956 and the Indian Council of Medical Research was started in 1949. Furthermore, the Central Government ministries like the Health ministry and Science and Technology ministry were responsible for the clinical, educational and research support. This allowed for the development of educational institutions that focused on Neurology.

History of Indian Neurology

The first account of a neurosurgical procedure in India is of a transsphenoidal hypophysectomy in 1935, which was performed by Lt. Col. Frederick Jasper Anderson in Madras.[12] However, the neurologists/neurosurgeons at the time were not trained in India. Instead, they went abroad to acquire specialized training. Therefore, it was a tremendous achievement when India offered graduate training in Neurology starting in the last quarter of the 20th century.

Initially, the field of Neurosciences was dominated by neurosurgeons. The first Neurological training facility was established in 1948 when the Director of Christian Medical College, Vellore extended an invitation to Dr. Jacob Chandy to start the Department of Neurosurgery at the college.[1] Following the establishment of the neurosurgery Department at the CMC, Vellore, numerous neuroscience departments were set up throughout the country. In 1950, Dr. B Ramamurthi initiated the second neurosurgery at Government General Hospital in Madras.[13] This facility would later become to be known as the Institute of Neurology, Madras. In 1951, the third neurosurgery department was initiated at Seth GS Medical College, Mumbai. In 1962, a Department of Clinical Neurosciences was established at the Postgraduate Institute, Chandigarh.[13] Later, a Department of Neurology was established at the Institute of Medical Science BHU in 1966 and Dr. BC Katiyar was appointed as the head of department. In addition, in 1974, All India Institute of Mental Health, which was started in 1954 as a mental hospital and asylum, was converted to an autonomous National Institute of Mental Health and Neurosciences. In 1976, the Sree Chitra Thirunal Institute of Medical Sciences and Technology added its neurological center of excellence. Furthermore, the Sanjay Gandhi Post Graduate Institute was established to focus on specialized education and research in various fields of medicine, which included neurology, in 1983. As a result of this progress in Neurology in India, there are currently over 1,100 qualified clinical neurologists working in the country. Also, there are about 59 MD programs instructing nearly 169 students annually and 39 DNB programs with 51 positions providing a form of postgraduate training in Neurology in a private practitioner based setting [Figures 10-12].[14]

The following table is a list of active Neurology Programs in India [Table 1] [Figures 13-17].

History of Neurosciences in India

Interestingly, the idea of establishment of neurosciences in India stemmed from the minds of clinicians in neurology. Hence, soon after the formation of the neurosurgery department at the CMC Vellore in 1949, the notion of setting up separate departments in basic neuroscience was conceptualized. The subsequent years saw the inception of Neurochemistry and Neurophysiology Departments at CMC Vellore followed by Neuropathology and Neurochemistry Departments at Madras Medical College.[15] Over the years, various places across India saw similar development in the field of basic neurosciences. Later, NIMHANS Bangalore added a Department of Neuropharmacology in addition to the already existing Departments in Neurosciences. However, AIIMS New Delhi was the only institution with a strong foundation in Neuroanatomy, Neurophysiology and Neurochemistry prior to setting up Clinical Departments.[15] Recognizing the need for a separate society for basic neurosciences, Professors K. P. Bhargava, B.

Table 1: Current neurology programs in India

States	DM neurology	DNB neurology
Andhra Pradesh	Andhra Medical College, Visakhapatnam	Apollo Hospital, Hyderabad
	Deccan College of Medical Sciences, Hyderabad	Care Hospital, Hyderabad
	Gandhi Medical College, Hyderabad	Kamineni Hospitals, Hyderabad
	Guntur Medical College, Guntur	Krishna Institute of Medical Sciences, Secunderabad
	Narayana Medical College, Nellore	Lalitha Super Specialty Hospital, Guntur
	Nizams Institute of Medical Sciences, Hyderabad	Sai Krishna Super-Speciality Neuro Hospital, Hyderabad
	Osmania Medical College, Hyderabad	Sri Venkateswara Institute of Medical Sciences, Tirupati
	Sri Venkateswara Institute of Medical Sciences, Tirupati	Yashoda Super Speciality Hospital, Hyderabad
		Indus Hospitals, Vishakapatnam
Assam	Guwahati Medical College, Guwahati	Institute of Neurological Sciences, Guwahati
Delhi	All India Institute of Medical Sciences, New Delhi	Army Hospital (R and R) Delhi
	Institute of Human Behaviour and Allied Sciences, Delhi	Indraprastha Apollo Hospitals
	Maulana Azad Medical College, New Delhi	Institute of Human Behaviour and Allied Sciences, Delhi
	PGIMER Dr. RML Hospital, New Delhi	Safdarjung Hospital and Vardhman Mahavir Medical College, Delhi
		Sir Ganga Ram Hospital, Delhi
		Max Super Specialty Hospital, New Delhi
		Vidyasagar Institute of Mental Health and Neuro Sciences, New Delhi
		Indraprastha Apollo Hospitals, New Delhi
Gujarat	Smt. N.H.L. Municipal Medical College, Ahmedabad	Sterling Hospital, Ahmedabad
Karnataka	Bangalore Medical College and Research Institute, Bangalore	Narayana Hrudayalaya, Bangalore
	Jawaharlal Nehru Medical College, Belgaum	St. John's Medical College, Bangalore
	Kasturba Medical College, Manipal	Manipal Hospital, Bangalore
	M S Ramaiah Medical College, Bangalore	
	National Institute of Mental Health and Neuro Sciences, Bangalore	
	S S Institute of Medical Sciences and Research Centre, Davangere	
	St. Johns Medical College, Bangalore	
	Vydehi Institute of Medical Sciences and Research Centre, Bangalore	
Kerala	Amrita School of Medicine, Elamkara, Kochi	Sudhamayi Hospitals and Clinics, Kollam
	Government Medical College, Kottayam	Baby Memorial Hospital, Calicut
	Govt. Medical College, Kozhikode, Calicut	Jubilee Mission Hospital, Thrissur
	Jubilee Mission Medical College and Research Institute, Thrissur	Kerala Institute of Medical Sciences, Kerala
	Govt. Medical College, Trivandrum	
	Sree Chitra Thirunal Institute for Medical Science and Technology, Trivandrum	
	Pushpagiri Institute Of Medical Sciences and Research Centre, Tiruvalla	
	T D Medical College, Alleppey	
Madhya Pradesh	Sri Aurobindo Medical College and Post Graduate Institute, Indore	Choithram Hospital and Research Centre, Indore
Maharashtra	Bombay Hospital Institute of Medical Sciences, Mumbai	Central India Institute of Medical Sciences, Nagpur
	Grant Medical College, Mumbai	Jaslok Hospital and Research Centre, Mumbai
	Seth GS Medical College, Mumbai	Lilavati Hospital and Research Centre, Mumbai
	Topiwala National Medical College, Mumbai	P.D. Hinduja National Hospital and Medical Research Centre, Mumbai
		Poona Hospital and Research Centre, Pune
		Sahyadri Speciality Hospital, Pune Fortis Hospital
Orissa	SCB Medical College, Cuttack	
Punjab	Christian Medical College, Ludhiana	
	Dayanand Medical College and Hospital, Ludhiana	
	Postgraduate Institute of Medical Education and Research, Chandigarh	

contd...

Table 1: Contd...

States	DM neurology	DNB neurology
Rajasthan	Dr SN Medical College, Jodhpur	
	Government Medical College, Kota	
	SMS Medical College, Jaipur	
Tamil Nadu	Christian Medical College, Vellore	Apollo Hospital, Chennai
	Chettinad Hospital and Research Institute, Kanchipuram	K.G. Hospital, Coimbatore
	Madras Medical College, Chennai	Meenakshi Mission Hospital and Research Centre, Madurai
	Madurai Medical College, Madurai	
	PSG Institute of Medical Sciences, Coimbatore	
	Sree Balaji Medical College and Hospital, Chennai	
	Sri Ramachandra Medical College and Research Institute, Chennai	
	SRM Medical College Hospital and Research Centre, Kancheepuram	
	Stanley Medical College, Chennai	
	Tirunelveli Medical College, Tirunelveli	
Uttar Pradesh	Chhatrapati Shahuji Maharaj Medical University, Lucknow	
	Institute of Medical Sciences, BHU, Varanasi	
	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow	
West Bengal	Burdwan Medical College, Burdwan	National Neuro Sciences Centre, Kolkata
	Institute of Postgraduate Medical Education and Research, Kolkata	Vivekananda Institute of Medical Sciences, Kolkata
	Medical College, Kolkata	
	Nilratan Sircar Medical College, Kolkata	

Figure 10: Christian Medical College, Vellore

Figure 11: Dr. Chandy seated second from the left (1963)

N. Dhawan, M. Hasan, S. S. Parmar and P. K. Seth collectively formed the Indian Academy of Neurosciences in 1982. The Academy currently boasts of more than 800 lifetime members, an official journal and a newsletter. After the establishment of renowned neuroscience centers at CMC, Vellore, Madras Medical College, NIMHANS, Bangalore, AIIMS, New Delhi, Kolkata and Trivandrum the Department of Biotechnology decided to form a National Brain Research Center in 1999 that is now completely dedicated to research in basic neurosciences. Furthermore, Cognitive Sciences Departments at Allahabad and Hyderabad and behavioral sciences center at Delhi have been recently established.[15] Various institutions nationwide offer postgraduate education and research opportunities in neurosciences like the Jiwaji University at Gwalior, NIMHANS, Bangalore, AIIMS, New Delhi, Tata Institute of Fundamental Research, Mumbai, Indian Institute of Science, Bangalore and the various research labs at the Council of Scientific and Industrial Research. In addition, there are several other notable institutions, organizations and neuroscientists that deserve a mention in this field.[15]

Pioneers of Neurology and Neurological Societies in India

The progress of Neurology in India is due to the efforts of multiple individuals during the 20th century. Some of the notable names are: Dr. Eddie Barucha, Dr. Jacob Chandy, Dr. Ram Ginde, Dr. T. K. Ghosh, Dr. S. T. Narsimhan, Dr. B. Ramamurthi,

Figure 12: Dr. Chandy inauguarates neurology wards (1953) with Rajkumari Amrit Kaur, Union Health Minister of India at the time[11]

Figure 14: Madras Institute of Neurology, Chennai

Figure 16: Sree Chitra Tirunal Institute of Medical Sciences and Technology, Cochin

Dr. Baldev Singh, Dr. Noshir Wadia, Professor Kalyanaraman and Professor Balasubramaniam. Dr. Eddie Barucha was the first practicing clinical neurologist in Bombay (1951).[16] Dr. Chandy helped start the first Department of Neurosurgery in India and was one of the founders of Neurological Society of India (NSI).[1] Dr. Ram Ginde was a neurosurgeon who started the third Department of Neurosurgery in India at Seth GS Medical College, Mumbai (1951). Dr. T. K. Gosh was a pioneer neurosurgeon in Calcutta and the second President of NSI.[1] Dr. S. T. Narasimhan was the first Indian neurologist to institute his private practice at the EEG clinic and was instrumental in the formation of the NSI.[1] Dr. B. Ramamurthi was a neurosurgeon who is credited with the creation of the

Figure 13: Sanjay Gandhi Postgraduate Institute, Chandigarh

Figure 15: National Institute of Mental Health and Neurosciences, Bengaluru

Figure 17: Institute of Medical sciences BHU, Varanasi

Department of Neurosurgery in Madras and co-founding of the NSI.[1] Dr. Baldev Singh, who received his neurological training in Chicago, USA, was the first Neuroscience professor in India and he is referred as "Papa Neuron". In addition, Dr. Singh was instrumental in the formation of NSI, led the Department of Neurology at All India Institute of Medical Sciences in 1965 and is regarded as the father of Indian neurology.[1] Dr. Noshir Wadia received his neurological training from London and then went onto to create and led the Department of Neurology at Grant Medical College in the 1960s.[1] Professor K. Jagannathan and Professor G. Arjundas were professors of Neurology and essential to the progress of Neurology in Madras.[1] It was with contributions of these individuals that Neurology was able to flourish in India [Figures 18-23].

As neurology started to grow in India, society's specific to neurology began to form. Currently the two major societies are: NSI and Indian Academy of Neurology (IAN).

NSI was the first organized society for Neurology in India and was founded in 1951 by Dr. Jacob Chandy, Dr. B. Ramamurthi, Dr. S. T. Narasimhan and Dr. Baldev Singh. Currently, the president of NSI is Dr. C. E. Deopujari. Sub-sections of NSI include Neurology, Neuropathology and Neuroradiology.

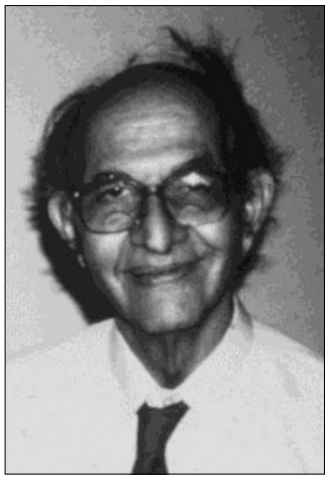

Figure 18: Dr. Eddie Barucha

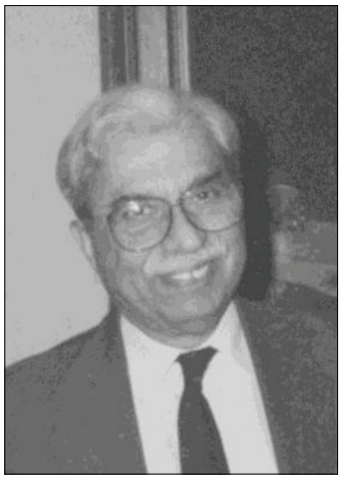

Figure 19: Dr. Noshir Wadia

Figure 20: Dr. Baldev Singh

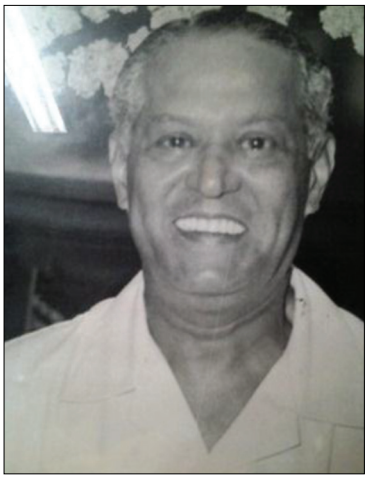

Figure 21: Dr. Ram Ginde

Figure 22: Prof. Kalyanaraman, Prof. B. Ramamurthi, Prof. Balasubramaniam

Figure 23: Dr. T. K. Gosh

NSI established the first official neurological journal of India: "Neurology India." By 1964, NSI was hosting meetings independent of the Association of Physicians of India. In 1972, NSI formed a committee to standardize the curriculum of residency programs. In 1974, NSI created the first CME program in Neurological Sciences, which became the first professional medical organization to provide such a program in India. In 1979, a sub-section of Association of Neurosciences Nurses was created to educate and prepare specialized nurses for managing only neurological disorders. In 1985, NSI issued guidelines for uniform curriculum of MCH in Neurosurgery in India. NSI has successfully organized the 9th International Congress of Neurological Surgery, 14th World Congress of Neurology and the 18th International Epilepsy Congress in India. Other major

accomplishments included seting up of Tumor and Stroke registries and traveling fellowships in early 1988.

Despite the success of NSI as a pioneering representative society of neurosciences in India, it was still a society dominated by neurosurgeons. Therefore, the IAN was established in 1991 by Dr. Chopra. The first elections and complete staff constitution of IAN were completed by 1993. IAN also formed its own offical journal called the "Annals of IAN." Intially when IAN was formed, there were 100 members; today, there are over 1,000 members [Figure 24].

Pioneers of Neurosciences in India

Since the establishment of Neuroscience as its own discipline in India during the Post-Independence era, many individuals have contributed to its foundation and current state. The most notable have been Drs. Jacob Chandy, B. Ramamurthi, R.G. Ginde, R.N. Chatterji, Ashok Bagchi, Baldev Singh, T.K. Ghosh, B.K. Bacchawat, D.K. Dastur, B.K. Anand, A.S. Paintal and K.P. Bhargava. However, many other names need to be noted in the establishment of the sub-Divisions of Neuroscience: Neurophysiology, Neuroanatomy, Neurochemistry, Neuropathology, Neuropharmacology and Neurotoxicolgy.

B. K. Anand, A. S. Paintal, P. Brahmayya Sastry, T. Desiraju, V. Mohan Kumar, K. N. Sharma, S. Dua-Sharma and others contributed greatly to the field of Neurophysiology. As for the field of Neuroanatomy, A. C. Das, Mahdi Hasan, K. K. Bisasria, N.H. Keswani, V. Mijlani, Gomathi Gopinath, Sashi Wadhwa and multiple others played a great role in its progress and success. After the establishment of centers devoted to Neurochemistry in the 1960s, J. J. Ghosh, B. K. Bachhawat, C. V. Ramakrishan, P. S. Sastry, G. P. Talwar, D. K. Basu, A. S. Balasubramanian, M. S. Kanungo, Shail Sharma, P. K. Sarkar, S. L. N. Rao, R. Rajalakshmi, K. Subba Rao, Valmikirnathan and numerous additional scientists helped develop and strengthen the field.[15] Dr. V. R. Khanolkar, C. G. S. Lyer, D. K. Dastur, Dr. S. Sriramachari, Dr. Ilona Bubelis, Dr. K. M. Wahal, Dr. Subimal Roy, Dr. A. K. Banerjee, Dr. Sarla Das, Dr. Sarasa Bharati, Chitra Sarka, Dr. Radhakrishnan, C. G. S. Lyer, C. K. Job, K. V. Desikan, V. R. Khanolkar, D. K. Dastur, N. H. Antia, L. Mehta, S. S. Pandya, M. C. Vaidya, M. G. Deo, G. P. Talwar, Indra Nath, Tandon, Wadia, U. C. Chaturvedi, Asha Mathur, Kalyan Banerji and others have aided the field of Neuropathology. As for Neuropharmacology, Dr. R. N. Chopra, B. B. Bhatia, K. P. Bhargava, B. N. Dhawan, R. C. Srimal, R. B. Arora, N. K. Bhides, U. K. Seth, Nilima Kshirsagar, P. C. Dandiya, M. K. Menon Jaipur, C. Sarkar, D. K. Ganguly, P. S. R. K. Harnath, S. K. Bhattacharya, P. K. Das, S. K. Kulkarni, G. V. Satyawati and additional scientists have played a great role in its achievements. Scientists from IITY, Lucknow, NIMHANDS, Bangalore and NBRC, Manesar helped establish the field of neurotoxicology. It was with the help of the scientists and leaders mentioned above that the field of Neuroscience became a distinct discipline. Many others have followed in their footsteps to help establish the current state of Neuroscience in India.[15]

Figure 24: Founder of Indian Academy of Neurology, Dr. Chopra

Current Neurology and Neurosciences in India and Its Future

There has been remarkable progress in every direction in the field of neurology during the last half century. However, there has to be a greater emphasis on research and academics that focuses on neurology. Many neurologists still go abroad to get their training due to the lack of resources. According to a research survey, 54.76% neurologists spend less than 5 h teaching/day. About 16% of neurologists spend up to 2 h a day on research and only 5.17% spend 3 h or more. Most neurologists agree that more time should be allocated to research and education.[17]

Furthermore, additional development in the field of Neurology is necessary to improve patient care. About 50% of neurologists spend 5-10 h a day with patients, 34% spend 10-15 h and 9% spend less than 5 h a day. In addition, around 50% of neurologists see 10-30 patients/day and 16% see more than 50. Most neurologists spend 15-30 min with each patient, but would like to spend 15-45 min. Approximately 24% of neurologists do not have facilities for investigation.[17] As a result of these statistics; there is a great void in patient care. Based on the prevalence studies, it is estimated that there are 20-30 million Indians suffering with neurological disorders. Of these, the most common disorders include epilepsy (6-8 million), stro kes (1-2 million) and headaches (10-12 million). Transient ischemic episodes were not included in this study which would easily account for higher stroke rates.[18]

Stroke is among the top 5 leading causes of death in India and WHO predicts that by 2015, India will report 1.6 million cases of stroke annually, at least one-third of whom will be disabled and by 2050. 80% of stroke cases in the world would occur in low and middle income countries mainly India and China. These statistics point towards a rising demand for neurologists and neurodiagnostic facilities in India. To meet the challenges of stroke in India, the Indian Stroke Association (ISA) was established in 2002 and currently has 600 members. Due to the combined efforts of ISA and IAN efforts, the number of stroke units in the country has

increased from 8 in 2009 to 20 in 2012.[19] The ISA is currently led by Dr. M. V. Padma Srivastava as the President and Dr. Vinit Suri as the Secretary.

Epilepsy is yet another commonly encountered neurological disorder in India which deserves a special mention due to the social stigma attached to it. Epilepsy has a wide treatment gap with high discontinuation rates due to various myths and misconceptions associated with this disorder. Recent community-based surveys have shown that epidemiological indices of epilepsy in India are comparable to those from developed countries, with a prevalence rate of ~5/1000 and incidence rate of ~50/100,000.[2] The Indian Epilepsy Association was formed in 1972 as result of the combined efforts of Dr. Eddie Bharucha, Dr. Noshir Wadia and Dr. Anil Desai who was then a designated secretary of Epilepsy section within NSI (1968-1969). The society rapidly gained importance and hosted the 18th International Epilepsy Congress in India at New Delhi in 1989. The society which started with 16 chapters has around 27 chapters all over India today with a total membership of over 1597. It is currently led by Dr. V. V. Nadkarni as the President and Dr. M. M. Mehndiratta as the Secretary.

With the growth in aging population, the cases with dementias are growing to exponential levels. In India, according to 2001 census there were 77 million people above the age of 60 and it is estimated that by 2025 this number will increase to 177 million. Due to lack of accessibility, most of these dementias go unrecognized until later stages of the disease and the burden of care falls in the hands of the care givers. Alzheimer's and Related Disorders Society of India is a non-profit voluntary organization that is engaged in the care, support, training and research of dementia. It was established in 1992 due to the dedicated efforts of Dr. Jacob Roy and the organization has grown to embrace 14 chapters nationwide today.

There are several other disorders like Parkinson's disease, Multiple sclerosis, neuromuscular disorders, neuroinfections and brain tumors which constitute the neurological maladies in India. The most important step in the management of these neurological disorders in India is the setting up of support groups and neurorehabilitative services. The Parkinson's Disease and Movement Disorders Society of India, which was established in 2001 is a non-profit organization, which aims toward successful coordination amongst various chapters and support groups. It is currently headed by Dr. BK Parekh as the President and Dr. B. S. Singhal as the Secretary. In addition, the Multiple Sclerosis Society of India, which was registered in 1985 as a voluntary, non-profit organization aids in the welfare of patients affected with this disorder. The society is comprised of nine chapters nationwide with its head office located in Mumbai.

On the neurosciences side, several major developments have occurred in the recent past. Currently the field of neurosciences in India not only includes clinical Departments like Neuroradiology, Neuroopthalmology, Neurootology, Neuroanesthesia, Neuroendocriniology, etc., but also includes basic sciences Departments like Developmental Neurobiology, Neuroimmunology, Neurovirology, Neurotoxicology, Neurooncology etc., in addition to Neuroanatomy, Neurophysiology and neurochemistry. More recently, Behavioral Neurology, Computational Neuroscience, System Neuroscience and Cognitive Sciences have been included.[15] In a recent analysis of research output in neurosciences in India, it was found that India ranked 21 among the top 26 countries in neurosciences with an average citation of 4.21/paper. India was far behind China, Brazil and South Korea in terms of publication output, citation quality and share of international collaborative papers in neurosciences.[20] These statistics indicate the dire situation of neurosciences in India. In order to ensure growth in neurosciences, changes need to occur at the grass root level. The academic institutions should educate and encourage the graduates and postgraduates about various courses available in the field of neurosciences. The academic institutions should organize awareness programs and specialized training programs targeted towards young researchers. The development of infrastructure is critical in strengthening the research initiatives. The clinicians should be encouraged to participate in research projects and be aware of the latest developments in neuroscience. Substantial measures should be taken to improve collaboration among the researchers and clinicians of various academic institutions both national and international.

Conclusion

Many crucial changes need to take place in the field of neurology and neurosciences in India. The neurologists and the neuroscientists have to work in synergy to ensure advancement in this field. The country needs more neurologists to meet the high volume of patients and neuroscientists to discover groundbreaking remedies. Funding for the betterment of these two societies is quintessential in managing the growing burden of neurological disorders. It is only through these changes in India we can expect to see growth not only the field of medicine, but also in neurology.

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