

The early years and development of electroencephalography in Spain

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ABSTRACT

Introduction. The purpose of this article is to analyse the introduction of electroencephalography (EEG) and its later developments in Spain, highlighting the main points of entry and how professional associations contributed to cementing the practice.

Methods. This article reviews historical medical literature about EEG and investigates collections kept by the Historical Archive of the Spanish Society of Neurology (1949-1979) and the Antonio and Manuel Subirana collection (1929-1990).

Results. Rafael Vara López was a pioneer in EEG studies at Hospital Provincial in Burgos. He maintained professional correspondence with Hans Berger and recorded Spain's first EEG in 1938. EEG devices were installed in Barcelona and Madrid in the 1940s through the mid-1950s. Sections dedicated exclusively to EEG recordings were created in Spanish hospitals between 1955 and 1966.

Discussion. EEG techniques were introduced later in Spain than in other countries, essentially owing to the Spanish Civil War, post-war conditions, and the country's political and social isolation. Private initiatives spurred use of the technique given that hospitals, university hospitals, and research centres found it very difficult to acquire machinery during the early post-war years. It was not until the mid-1950s that hospitals and medical schools began to have access to electrophysiology equipment. As EEG devices were introduced, associations began to form to investigate the technique. This culminated in 1950 with the creation of the Study Group for Electroencephalography and Clinical Neurophysiology, a division within the Spanish Society of Neurology.

KEYWORDS

History of electroencephalography, EEG, history of neurology

Introduction

In 1875, English physiologist Richard Caton used a galvanometer connected to the cerebral cortex of monkeys and rabbits to measure cortical electrical activity. Ernst Fleischl von Marxow confirmed Caton's experimental findings in dogs in 1890 and also observed that chloroform narcosis suppressed electrobiological brain activity. Hans Berger, professor of psychiatry and neurology at the University of Jena, was first drawn to Caton's and von Marxow's studies in 1902. In 1924, he himself recorded an EEG from the cerebral cortex of a 17-year-old boy during an operation performed by neurosurgeon Nikolai Guleke.¹ He published his conclusions in 1929 and documented the concepts of alpha and beta waves.²

Between 1913 and 1925 Pravdich-Neminsky (or Práwdwicz-Neminski) used a string galvanometer to record electrical potential oscillations in the dog brain and found two types of wave, one with a frequency of 10 to 15 c/s and the other with a frequency of 20 to 32 c/s. He was even able to record activity through the skull.³

Gibbs and Grass introduced the ink-writer in 1935, an innovation which made reading records easier. The same year, Gibbs, Davis, and Lennox described the traces recorded during epileptic seizures; Grey Walter was the first to use it to locate brain tumours.¹

In 1939, Gibbs published *Atlas of Electroencephalography*, which offered a system for examining the morphology of

brain oscillations. In 1941, Jasper, Penfield, and Erickson, drawing from their experience with epilepsy, transformed EEG into an indispensable instrument for experimental and clinical studies of cerebral processes. After World War II, advances in the field of electronics gave rise to highly precise and valuable tools for recording cerebral activity.^{1,3}

The purpose of this article is to analyse the introduction of EEG in Spain and its further development, highlighting the main points of entry and how groups dedicated to this practice were established.

Methods

This article reviews historical medical literature about EEG and presents a study of the collections kept by the Historical Archive of the Spanish Society of Neurology (AHSEN, 1949-1979) and the Antonio and Manuel Subirana collection (1929-1990).

Results

Main points of entry in Spain

Rafael Vara López was a pioneer in EEG studies at Hospital Provincial in Burgos (Figure 1). He exchanged professional correspondence with Hans Berger and recorded the first EEG in Spain in 1938, using a single-channel device lent to him by Halle's surgical clinic through the agency of the German embassy. His EEG studies focused on different types of narcosis, insulin coma therapy, cerebral abscesses, and intracranial tumours.^{4,5}

Between 1940 and 1945, neurosurgeon Adolfo Ley and physiologist Juan Jiménez Vargas recorded several EEGs at the Barcelona Faculty of Medicine. Jiménez Vargas also made recordings of cases studied by Professor Soriano's clinical teaching unit or by Luis Barraquer Ferre's school of neurology at Hospital de la Santa Creu i Sant Pau.⁶

In 1946, Luis Oller-Daurella and Antonio Subirana installed the first multichannel (two-channel) EEG device in Spain; their studies focused on epilepsy. Spain's political isolation made it difficult to import electronics of any type, but with the help of a high-ranking friend in customs, Subirana managed to import this device, which was then used in his private office. He and



Figure 1. Rafael Vara López (1904-1982). Burgos Municipal Archive.

his friend Gálvez, an expert in electronics and cardiac event recorders, transformed the EEG device into a four-channel machine using the replacement parts they had ordered for the original machine. Subirana and Oller-Daurella were the first to record point-wave complexes in patients with absence seizures with clonic components.³

In Barcelona, between 1947 and 1950, José Vila Badó, José María Samsó, and Rafael Papi channelled all their professional activity into EEG studies. They may be considered Spain's first full-time experts in the field. In 1949, Vila Badó and Samsó set up an EEG room at Clínica Corachán in Barcelona with equipment they had imported from the USA.³

The first device manufactured in Spain was made by Soler Bachs and Samsó. It was installed in Hospital Clínic in the clinical teaching unit headed by Professor Pedro Pons. Later on, between 1951 and 1954, Vila Badó and Samsó set up EEG units at Hospital de la Santa Creu i Sant Pau,

Hospital de Infecciosos (currently known as Hospital del Mar), and Hospital de la Cruz Roja.⁵ Soler Bachs split from the rest of the group and installed an EEG machine in the department of psychiatry headed by Sarró. One noteworthy example among their early studies, published by Vilá Badó and Schwab, addressed electroencephalography in cerebrovascular disease.⁷

In Madrid in 1950, neurosurgeon Sixto Obrador had a four-channel device installed. The same year, Antonio Vallejo Nájera, department chair of psychiatry, set up an EEG unit at the Madrid Faculty of Medicine. Headed by Larramendi, this unit trained such important figures as José Carlos Oliveros, Juan Mármol, and José Carbonell. The Institute of Medical Research, directed by Jiménez Díaz, was also provided with 4-channel and 6-channel devices manufactured by Grass and Reega; Larramendi led this division as well.⁵

In 1952, Aniceto Fernández-Armayor organised a neuropsychiatry department at the former Spanish national institute of medicine, where he also set up a neurophysiology unit. In that unit, working in partnership with Dubost, he used EEG recording during the first extracorporeal intervention in Spain, performed by La Fuente in 1959.³

The EEG department at Hospital General in Madrid was inaugurated in 1953. It was directed by P. de Castro, who had studied clinical neurology and neurophysiology in Montreal with Jasper and Penfield, at La Salpêtrière with Alajouanine, and in the psychiatric hospital of Bonneval under Henry Ey. His department's excellence was a reflection of the training of many who were both clinical neurologists and EEG experts, such as J. M. Sacristán, G. Moya, and F. R. Sanabra. Based on recordings from 1063 epileptic patients, these doctors published one of the first monographic studies on epilepsy and EEG.⁸

In October 1953, P. de Castro and Sacristán set up an EEG department equipped with a 12-channel Reega device. Most of their patients came from the neuropsychiatric departments headed by Lafora and López Ibor, the neurosurgery department directed by Díaz Gómez, and Marañón's endocrinology department. These authors displayed particular interest in abnormalities in EEG traces in different endocrine disorders and also tried to establish a link between EEG findings and mesodiencephalic dysfunction secondary to hormonal imbalance. Addison disease was studied in detail in 37 cases. Doctors discovered abnormal EEG traces in 82%

of the patients. They observed bursts of bilaterally synchronous slow waves in five patients during hyper-ventilation activation. They also found that these abnormalities in EEG traces disappeared when adrenaline was administered.⁵

Units dedicated exclusively to EEG recordings were created in Spanish hospitals between 1955 and 1966. In addition to those already mentioned, Rafael Papí created an EEG unit within the neurosurgery department headed by Adolfo Ley at Hospital Clínic, Barcelona. In Madrid, similar sections were created at Hospital Clínic under José Carlos Oliveros and Hospital La Paz, led by José Carbonell. In Valencia, Barcia Goyanes had two EEG devices installed in the Faculty of Medicine. Lastly, Seville, Pamplona, San Sebastian, and Oviedo also created EEG units.

Institutionalisation

On 27 June 1949, Antonio Subirana, Juan José Barcia, and Sixto Obrador presented their proposal for the establishment of the Spanish Society of Electroencephalography, with its draft statutes, to the civil governor of the province of Barcelona.⁹ The rejection of that proposal on 19 December of the same year led to a new proposal to create a division within the Spanish Society of Neurology (SEN). The purpose of this initiative was to legally establish the group that would subsequently participate in international conferences on EEG and join the International Federation of EEG Societies. The Study Group for Electroencephalography and Neurophysiology was approved unanimously. Beginning in 1950, it organised scientific meetings in partnership with the SEN (Figure 2). Eighteen communications were presented in its inaugural session. The following foreign guests presented their research: R. Lorente de Nó of the Rockefeller Institute in New York, on synaptic transmission; H. Jasper from Montreal, president of the International Federation of EEG Societies, on electroencephalographic morphology, localisation, and diagnosis; W. Grey Walter from Bristol, on EEG and epilepsy; and Gastaut from Marseille, on the electroclinical classification of epilepsy.¹⁰

The study group worked actively to establish and organise EEG units in Spain. On 6 May 1954, the group presented a memorandum on the organisation of clinical EEG units within the framework of the compulsory health coverage (SOE in Spanish) provided by the former

Spanish national institute of social insurance.¹¹ This memorandum was in line with the SOE's aim of launching and organising these departments. This was achieved in 1956 in Barcelona, Bilbao, Granada, A Coruña, Madrid, Seville, Valencia, and Zaragoza once candidates had been selected by means of the appropriate competitive exams.¹² In June of the same year, a conference titled "Physiology, electroencephalography, and pathology of the mesodiencephalon" was held at the facilities of the Spanish National Research Council in Madrid. The conference was directed by Sixto Obrador and several international speakers, including F. Bremer, also participated.⁵

In 1961, the group informed the SEN of their intention to form an independent society. The statutes of the Spanish Society of Electroencephalography and Clinical Neurophysiology were approved by the Ministry of

Home Affairs on 28 November 1963. Consequently, the SEN Study Group for Electroencephalography and Clinical Neurophysiology was dissolved.

Discussion

EEG techniques were introduced later in Spain than in other countries for a number of reasons, particularly the Spanish Civil War, post-war conditions, and the country's political and social isolation. Private initiative spurred use of the technique since it was very difficult for hospitals, university hospitals, and research centres to acquire devices and other material during the early post-war years. It was not until the mid-1950s that hospitals and medical schools began to have access to electrophysiology equipment. As EEG devices were introduced, doctors formed associations to investigate



Figure 2. Drs Solé Bachs, Samsó, Vilabado, Moya, Subirana, Oller, ?, Castro. Sixth Annual Meeting of the SEN, Seventh Meeting of the Hispano-Portuguese Society of Neurosurgery. Barcelona, 2 to 4 April 1955. SEN historical archive.

the technique. This process culminated in 1950 with the creation of the Study Group for Electroencephalography and Clinical Neurophysiology, a division within the Spanish Society of Neurology.

References

1. Niedermeyer E, Lopes da Silva F, eds. *Electroencephalography: basic principles, clinical applications, and related fields*. Philadelphia: Lippincott Williams & Wilkins; 2005.
2. Berger H. Über das Elektroencephalogramm des Menschen. *Arch Psychiatr*. 1929;87:527-70.
3. Balcells M. *Historia general de la neurología*. Esplugues de Llobregat: Grupo Saned; 2009.
4. Vara R. *El cirujano ante la muerte*. Burgos: Ayuntamiento de Burgos; 2002.
5. Castro P. Actualités EEG et neurophysiologiques en Espagne. 1954. 11 p. Location: SEN Historical Archive, Antonio and Manuel Subirana collection; document 26-1-7.
6. Jiménez J, Barraquer B. Observaciones electroencefalográficas en enfermos epilépticos. *Med Clin (Barc)*. 1944;6:485-6.
7. Schwab R, Vila J. El estudio electroencefalográfico en las enfermedades vasculares cerebrales. *Med Clin (Barc)*. 1955;4:280-6.
8. Castro P, et al. *Síndromes epilépticos: estudio clínico, electroencefalográfico y psicológico*. Madrid: Científico-Médica Española; 1960.
9. Subirana A. Carta al Gobernador Civil de la Provincia. 27 June 1949. Location: SEN Historical Archive, Antonio and Manuel Subirana collection; document 26-2-10.
10. Reunión inaugural del Grupo Español de Electroencefalografía y Neurofisiología Clínica de la SEN. Programme; Barcelona, 9 December 1950. Location: SEN historical archive; document 1-1/1950.
11. Obrador S, Castro P. Memoria que presenta el Grupo Español de Electroencefalografía y neurofisiología clínica de la Sociedad Española de Neurología sobre la organización de servicios de electroencefalografía clínica para el Seguro Obligatorio de Enfermedad. 1954. 13 p. Location: SEN Historical Archive, Antonio and Manuel Subirana collection; document 26-2-19.
12. Convocando concurso-oposición para cubrir plazas de Jefes de los Servicios de Electroencefalografía para las Residencias Sanitarias del Seguro Obligatorio de Enfermedad. *Boletín Oficial del Estado*, no. 361, 27 December 1955. p. 7924.
13. Sociedad Española de Neurología Libro de Actas (1949-1972). Location: SEN Historical Archive, Antonio and Manuel Subirana collection; document 1-1/1949.