Barraquer Ferré and De Gispert, 1936: detection of the Majorca focus of familial amyloid polyneuropathy

S. Giménez-Roldán[1], A. Barceló Rosselló[2]

[1]Former head of the Department of Neurology. Hospital General Universitario Gregorio Marañón, Madrid, Spain.
[2]Former head of the Department of Neurology. Hospital Universitario Son Dureta, Palma de Mallorca, Spain.

ABSTRACT

The Majorca focus of familial amyloid polyneuropathy (FAP) is the fifth largest in terms of prevalence, after the foci in Portugal, Japan, Brazil, and Sweden. It is generally accepted to have been recognised in 1976 by the distinguished Majorcan internist Munar-Qués. However, in 1936, Barraquer Ferré and De Gispert Cruz, two experienced Catalan neurologists, examined three siblings of Majorcan origin in Barcelona, who presented clinical signs consistent with FAP. Over two generations, 13 members of their family had developed a similar disease. They published their findings in the journal *Deutsche Zeitschrift für Nervenheilkunde* as a case of lumbosacral syringomyelia, an inaccurate but common term at the time for deficits in temperature and pain sensation in the legs, often associated with painless foot ulcers. The unfortunate management of the spinal cord specimen obtained in the autopsy study of the youngest sister revealed a cystic formation in the lower half, whereas the upper half had disappeared, probably due to putrefaction. Barraquer Ferré and De Gispert Cruz were the first authors worldwide to describe the clinical picture of FAP, its autosomal dominant inheritance pattern, and its relationship with the island of Majorca. Their article inspired the research of Munar-Qués, who played a crucial role in our understanding of the disease.

KEYWORDS

Ulcerative-mutilating acropathy, Barraquer Ferré, De Gispert Cruz, plantar mal perforant, Majorca, Munar-Qués, familial amyloid polyneuropathy, lumbosacral syringomyelia

Introduction

Familial amyloid polyneuropathy (FAP) is a hereditary disease of adult onset, which causes death within 10-15 years if untreated. The disease results from a point mutation that causes extracellular deposition of the insoluble fibrillary protein transthyretin (TTR). Normal TTR is generated in the liver, and to a lesser extent in the choroid plexi and choroid layer of the eye, and is responsible for transporting thyroxine and vitamin A.[1] Misfolding of the protein results in mutant TTR (TTR-FAP), causing accumulation of a 127–amino acid amyloidogenic fibrillary protein in the nerves, heart, eye, and kidneys. In the peripheral nervous system, amyloid deposition preferentially causes atrophy of non-myelinating Schwann cells (Remak cells) and loss of small myelinated fibres in the peripheral nerves; clinically, causes dysautonomic manifestations. In the vasa nervorum, the disease causes proliferation of endothelial cells, resulting in blood-brain barrier alterations and, ultimately, vascular occlusion.[2] While over a hundred TTR mutations have been described, the majority of cases in Spain are caused by the Val30Met mutation.[3]

The erroneous concept of lumbosacral syringomyelia was accepted by neurologists for a significant part of the 20th century. This mistaken belief stemmed from the observation of processes that progressed with certain

Corresponding author: Dr Santiago Giménez Roldán
E-mail: sgimenezroldan@gmail.com

Received: 14 December 2022 / Accepted: 28 January 2023

Aus der Klinik für Neuropathologie des Hospitals de la Santa Creu i Sant Pau, Barcelona. (Vorstand: Prof. Dr. L. Barraquer.)

Die Syringomyelie, eine familiäre und hereditäre Krankheit.

(13 Fälle in 2 Generationen derselben Familie.)

Von

Dr. **Luis Barraquer** und Dr. **Ignacio de Gispert.**

Mit 4 Textabbildungen.

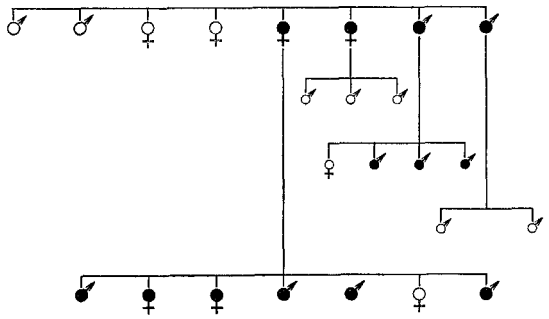

Abb. 1. Vollschwarz sind an Syringomyelie Leidende.

Figure 1. Top: the title of the original publication in German: "On syringomyelia, a hereditary familial disease." Bottom: pedigree chart showing the 13 affected family members over two generations. Munar Qués later expanded the series to include 15 cases. De Gispert I. *Memòries d'un neuròleg que fou metge de batalló*. Barcelona: Editorial Selecta; 1976.

clinical signs in the legs, resembling manifestations of classical cervicothoracic syringomyelia, such as loss of pain and temperature sensation; painless ulcers, sometimes requiring amputation; and muscle atrophy. Lumbosacral syringomyelia was first described by Bruns,[4] in 1903, in patients with diabetic neuropathy; the clinical syndrome later came to be known as plantar mal perforant. It may be observed in patients with lesions to the peripheral nerves or nerve roots secondary to leprosy,[5,6] tabes dorsalis,[7] or chronic alcoholism.[8,9] The outdated term lumbosacral syringomyelia has also been applied to a range of diseases of the conus medullaris and cauda equina, whether due to infection,[10] tumours or massive disc herniation,[11] or lumbosacral lipoma in children with tethered spinal cord syndrome.[12]

The Parisian surgeon Auguste Nélaton (1807-1873)[13] had practised plastic surgery, which led him to attend three siblings with painless foot ulcers. This was the first evidence of a hereditary form of the disease, which was considered at the time as familial lumbosacral syringomyelia. André Thévenard (1898-1959), a neurologist at the Salpêtrière, first reported the hereditary form at the age of 31, in a Jewish family,[14] and subsequently dedicated a considerable part of his career to the disease. To his frustration, he never had the chance to confirm the seat of the disease in an anatomical study, and opted for the less compromised term "familial ulcerative-mutilating acropathy."[15,16] He made do with speculation as to the possible "dysraphic" origin of the disease due to abnormal closure of the lumbosacral spine.[17] With the exception of a brief obituary by Raymond Garcin,[18] little is known of the life of this important figure (O. Walusinski; personal correspondence). Not even a photograph remains.

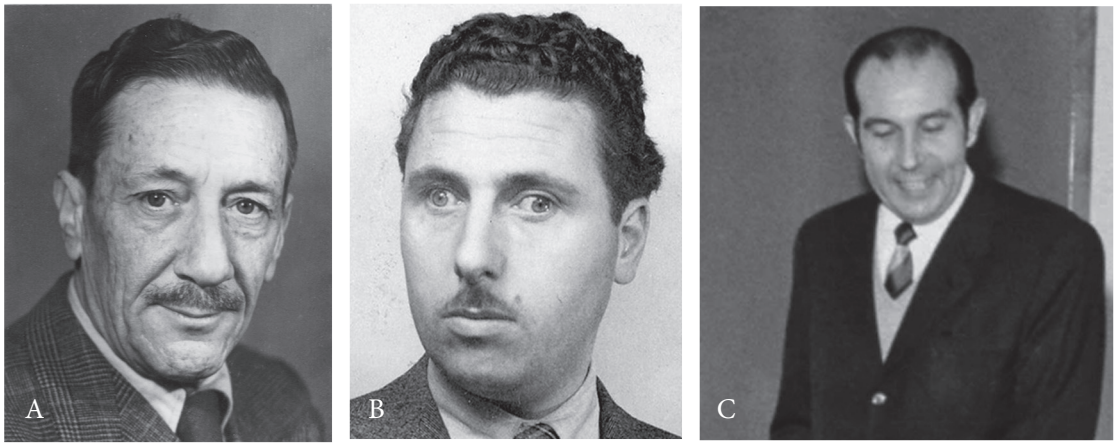

Figure 2. A) Lluís Barraquer Ferré. B) Ignasi de Gispert Cruz as a young man. C) Miquel Munar-Qués.

In 1936, Barraquer Ferré (1887-1959) and De Gispert Cruz (1903-1984) published an article in the prestigious German journal *Deutsche Zeitschrift für Nervenheilkunde*, reporting their findings in three members of a peculiar family of Majorcan origin, who without a doubt had emigrated to Barcelona. According to the patients and information from a colleague settled in Majorca, a total of 13 individuals from 2 generations of the family had presented similar signs. In the light of the combination of foot ulcers and a dissociated sensory disorder, they presented their case as "the only example in the literature of hereditary lumbosacral syringomyelia" (Figure 1).[19]

We should note the great scientific prestige and influence of Barraquer Ferré and De Gispert Cruz in Spanish neurology. The former was one of the founders of the Spanish Society of Neurology in 1949,[20] and the latter was a man of great force of will and erudition.[21,22] Together with Emili Castañer i Vendrell, they published the monumental two-volume treatise *Tratado de enfermedades nerviosas* (Manual of nervous system diseases; 1936, 1940). Despite their insistent error in considering this large Majorcan family to present familial lumbosacral syringomyelia, which is today merely a historical curiosity, we must consider the unquestionable merit of reporting the first evidence of a Majorcan focus of FAP (type I).

This article addresses a surprising intrahistory: from the error defended for 19 years by the Barraquers[16,20] to the work of the eminent Majorcan physician Miquel Munar-Qués (1924-2008) to develop the understanding and treatment of the disease. This whole process was somewhat reminiscent of a detective story, marked by intuition and perseverance (Figure 2).

Material and methods

After the translation into Spanish of the German-language article by Barraquer Ferré and De Gispert Cruz, we tried, not always successfully, to contact professionals in Majorca who may be able to provide details on the history of FAP (see Acknowledgements). We also contacted the Association of Andrade Disease of Valverde, in Valverde del Camino (Huelva), via its excellent web page.[A] We consulted Dr Olivier Walusinski (Brou, France), an expert on the history of neurology, for potential biographical data on Thévenard. The article also addresses the life and work of Dr Miquel Munar-Qués (1929-2018), a historical reference on FAP in his native Majorca, including the book dedicated to him there.[B]

[A]https://www.enfermedadandradevalverde.com/

[B]Riutord Sbert P, Forteza Alberti JF. Evocació del Dr. Miquel Munar Qués. [s.l.]: Bassus Ediciones; 2020. https://www.saludediciones.com.

Many articles were obtained with the help of Vanessa Cisteré (Museo-Archivo Histórico of the Spanish Society of Neurology) and María José Rebollo (library of the Official College of Physicians of Madrid); books and pamphlets from the personal library of one of the authors (SGR) were also consulted.

Results

A Majorcan family in Barcelona

Over 19 years (1936-1955), Barraquer Ferré and Barraquer Bordas repeatedly cited the famous case of "familial lumbosacral syringomyelia" published in the German journal *Deutsche Zeitschrift für Nervenheilkunde.* There are two reasons for this persistence: firstly, the high number of cases, with a total of 13 from two generations of the family, truly unusual in the literature on the disease known as familial Thévenard disease, which had until that time been limited to two or three cases per family. The second reason was the supposed nosological classification of the disease as lumbosacral syringomyelia. This is clearly expressed in the following excerpt from the 1936 article:

> To our knowledge, no article in the neurological literature reports such a large number of patients, all belonging to a single dysraphic family […], a series of 13 individuals in whom syringomyelia manifested with the typical symptoms. The first two patients were admitted to hospital and were studied there. Information on the remaining cases was provided by the patients themselves and by Dr Pascual of Palma de Mallorca, whom we thank for his assistance.

In fact, these are two branches of a single family. Branch "F" includes the two admitted patients, Matías F., 34 years old, a waiter, and Mateo F., 30 years old, a carpenter, who without a doubt would have emigrated from the Balearic Islands to Catalonia. Years later, they again came across Margarita, the youngest of the three siblings. The other branch of the family (branch "G"), included the brothers Pepe and Jaime, aged 40 and 37 years, respectively, whose data were sent from Majorca by Dr Pascual, probably their family physician. The authors were somewhat lax in their description of the patients' place of origin, noting that Matías F. had been born in "Laro" (most probably Alaró, as confirmed years later by Munar-Qués), and that Pepe G. was born in "Saro" or "Sarro," both of which we have been unable to identify.

The clinical picture was remarkably similar in all three of the patients examined. All three presented painless ulcers on the feet, loss of pain and temperature sensation in distal regions of the limbs, paraesthesia, considerable difficulty walking, and occasional cramps. All three siblings also presented sphincter disorders, as well as alternating episodes of persistent diarrhoea and prolonged constipation (Figure 3).

The frustrated post mortem examination of Margarita

The case of Margarita is somewhat special. By chance, the authors met her again eight years later, hospitalised at the surgical department, during a hospital interconsultation to rule out suspected leprosy, an infectious neurological infection that was not uncommon in Catalonia at the time and whose diagnosis was always challenging.[11] In fact, they continued to consider the possibility of "neurotrophic leprosy" due to the persistent chronic ulcer on her left foot, from which two toes had been amputated. Now at a very advanced stage of disease, the patient used a wheelchair and presented extensive oedema of the legs and clear claw hand deformity. Anaesthesia nearly reached the groin, unlike in the examination performed years earlier (Figure 4). Especially problematic was the "prolonged diarrhoea," which could not be controlled by the usual means, and led to the patient's death 18 months later.

In 1953, Lluís Barraquer i Bordas (1923-2010),[21] the son of Barraquer Ferré and grandson of Barraquer Roviralta, contributed some details of the mysterious disappearance of part of the patient's spinal cord:

> One of us (LBB) deposited this specimen at the laboratory of histology and anatomical pathology at the Faculty of Medicine in Barcelona, whose chair was unoccupied at the time. We were never informed that a histopathological study had been performed, and later enquiries to this effect were fruitless. Thus, we lost the chance for histological verification, clearly of primordial interest, of what appears to have been a princeps case.

However, simple visual inspection was deemed sufficient to determine the limits of a supposed cyst in the most distal section of the spinal cord, with its "structure of thin walls." No mention is made of what would seem more striking, that is what may have happened to the other, lost, half of the spinal cord.

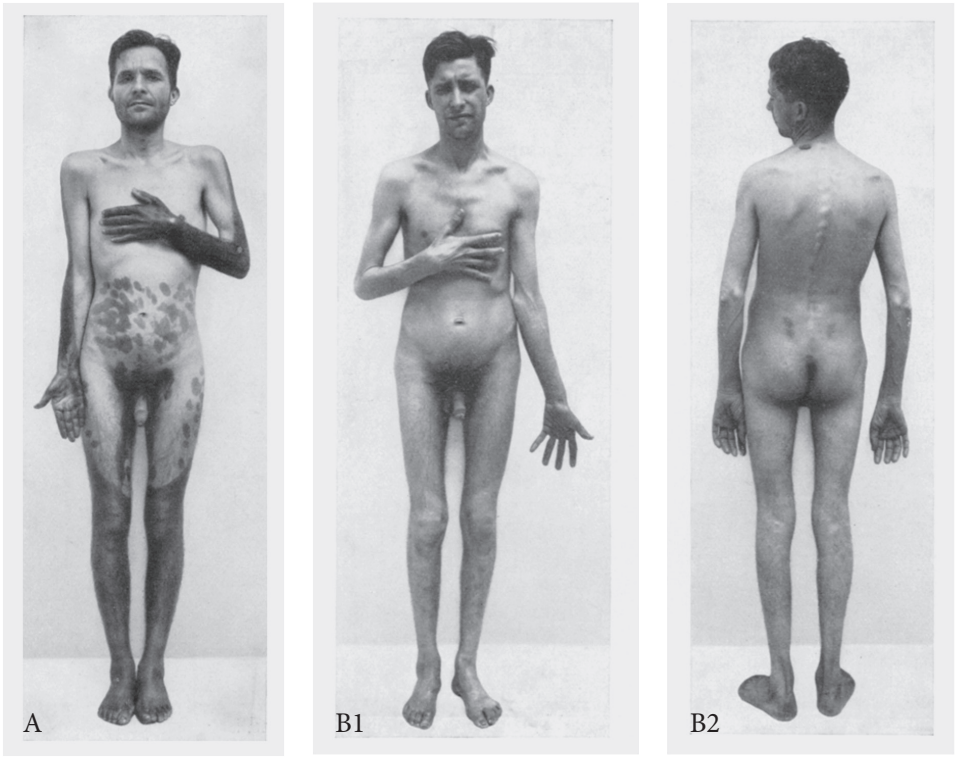

Figure 3. The two brothers admitted to Sant Pau: Matías (A), aged 34 years, with extensive deficits in temperature and pain sensation, and Mateo (B1 and B2), aged 30 years, with distal muscle atrophy in both legs.

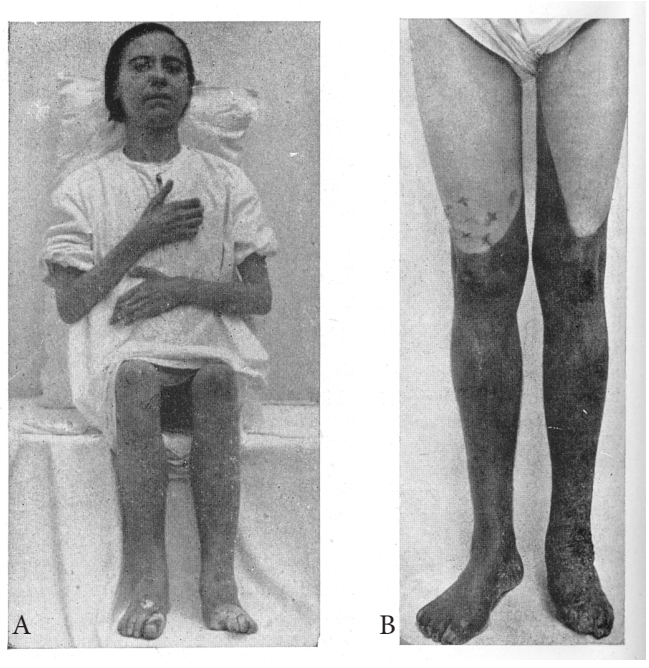

Figure 4. Margarita, a year and a half before her death, with extensive oedema in the legs, muscle atrophy in both hands (A), and reduced sensitivity up to the knees (B).[35]

Discussion

The circumstantial power of the prevailing wisdom, uncritical tendencies, and "influencers" have always had an impact on publication in medicine. Thus, we may wonder whether Barraquer Ferré and De Gispert, two well-trained and hugely experienced neurologists, may have been bewildered after learning of a disease affecting no fewer than 13 members of a single family. As the authors believed they may be facing a hereditary disease of the spinal cord, they could not have avoided being perplexed (and doubtful) after examining the patient Mateo F. (case 2), whose gait was "like that seen in polyneuritis" and showed "distal paralysis of foot dorsiflexion." Neither did they consider the significance of the marked muscle atrophy of the hands in both brothers, assuming a priori, despite all the evidence, that the symptoms were caused by involvement of lumbar and sacral spinal cord segments.[19]

With regard to the famous cyst, we may only speculate that, as the specimen was abandoned at the laboratory, it would have been subjected to the unyielding laws of putrefaction. Perhaps due to the high temperature and humidity in Barcelona, this valuable piece in all likelihood rapidly began the habitual process of autolysis, with the formation of gases, large blisters, and liquefaction.[22] In summary, they imprudently overestimated the value of an anatomical specimen that had visually deteriorated at a laboratory that lacked a director.[21] Denny-Brown[23] had ruled out lumbosacral syringomyelia in the autopsy study of a woman from London studied years earlier by Hicks,[24] settling on a diagnosis of hereditary sensory radicular neuropathy. Thévenard, in turn, ruled out the anatomical contribution of the Barraquers in a review summarising years of work, noting discreetly that "circumstances prevented a full examination."[16] A powerful "influencer" was L. Van Bogaert (1897-1989), one of the most noteworthy neuroscientists of the 20th century,[25] who had a particularly long-lived relationship with Spanish neurology: he continued to defend the erroneous concept of lumbosacral syringomyelia for over 20 years after the publication by the Catalan authors. Indeed, such important figures in the history of FAP as Corino Andrade[26] and Munar-Qués[27] had at least initially accepted the diagnosis of lumbosacral syringomyelia in patients with FAP.

The circumstances were also against them. By the time the princeps case was published, Barraquer Ferré had replaced his father Barraquer Roviralta (who died in 1928) as chief of service at the old Sant Pau hospital, where his father's disciple Ignasi de Gispert continued working.[28,29] From 26 July 1936, the anarchist union CNT-FAI took over the administration of the centre now known as Hospital General de Catalunya, which, on a daily basis, received numerous wounded soldiers and victims of the bombing of the city (Figure 5). Ignasi de Gispert was soon called up to serve as a battalion physician in the Republican army. With a touch of humour, he later described his adventures in his army years in a delightful book.[30,31]

Dr Miquel Munar-Qués (Palma de Mallorca, 1924-2018) was a well-regarded figure after 24 years leading the internal medicine department at Hospital Provincial de Baleares. He indisputably played a key role in shining a light on FAP and bringing it into the modern day: reporting what Andrade disease was in an article in *Medicina Clínica*,[32] signalling its high prevalence in the Balearic Islands in a lecture to the Spanish National Royal Academy of Medicine in Madrid,[33] performing an exemplary epidemiological study in Majorca and Menorca,[27] directing the first liver transplant in 1991, and creating a multidisciplinary clinical and research team, today Hospital Universitario Son Llàtzer.[34]

It is essential to note the nearly detective-like method, proper of an experienced clinician, by which Munar-Qués discovered FAP in Majorca. Though he was perhaps unaware of the publication in German, it is clear that he used Barraquer Ferré's extraordinary 1952 book *Estudios de neurología clínica* (Studies in clinical neurology),[35] a compendium of his numerous publications and a wealth of images (many inherited from his father), as a key source of information. At an unspecified time, Prof Munar was attending a woman with peculiar neurological symptoms, which he diagnosed as familial lumbosacral syringomyelia. A brother, a cousin, and her parents, now deceased, had presented similar symptoms, presumably studied in Barcelona.

In line with the story of the presumed cyst found on the spinal cord of Margarita F., and probably aware of Denny-Brown's[23] article on a member of the family reported by Hicks,[24] he performed an exploratory laminectomy. He did not observe the cyst so fiercely defended by the Barraquers, but he prudently opted to extract a dorsal root ganglion, which he sent for analysis by Dr J. Lamarca, pathologist at Hospital del Mar in Barcelona. Hae-

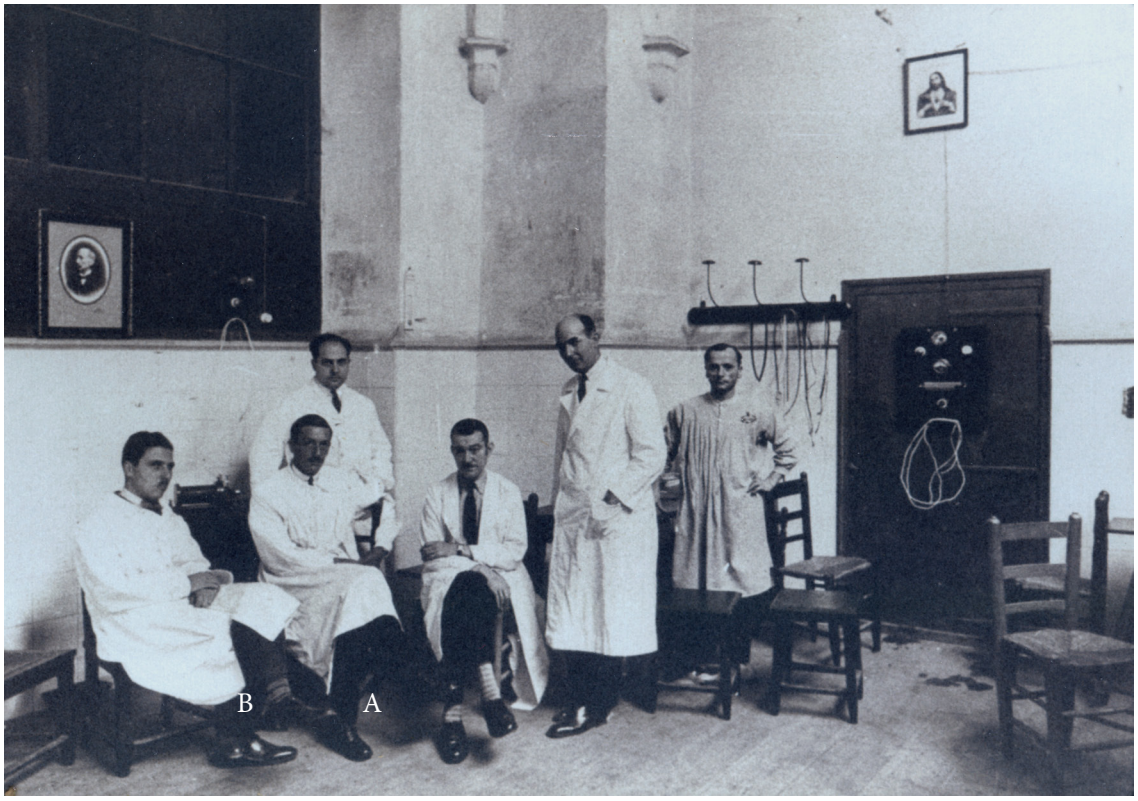

Figure 5. The neurology department at the old Hospital de Sant Pau. Barraquer Ferré is in the centre (A), underneath a photograph of his father, with De Gispert to his right (B). Source: SEN Historical Archive.

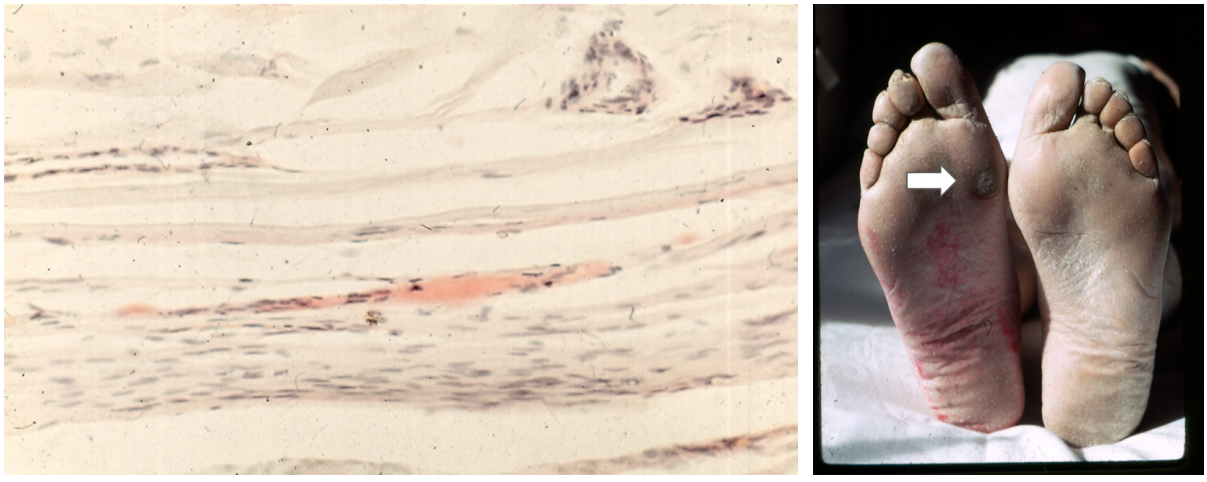

Figure 6. Scar from an extensive plantar ulcer at the head of the first metatarsal of the right foot (photograph by the author) and a histology image of the sural nerve from the same patient, displaying masses of amyloid material marked with Congo red stain, displacing the nerve fascicles (study by Dr Walter G. Bradley, Regional Neurological Centre, Newcastle upon Tyne, UK).

matoxylin-eosin staining yielded normal results: no loss of ganglion cells or amyloid deposition. Perceptively, Munar-Qués insisted that the pathologist also try Congo red stain, which is specific for amyloid. Fortunately, the biopsy specimen had not met the same fate as the spinal cord of the patient Margarita F. The study yielded positive results, and thus represented the first histological confirmation of a case of FAP in Majorca. When his patient's 26-year-old daughter became ill, Munar expanded the series of Barraquer and De Gispert from 13 to "15 cases distributed in two towns" (one was Alaró, and we have been unable to identify the other).[27]

Today, FAP continues to be relatively common in Majorca (107 detected cases of the mutation in recent years, of whom 53.3% are carriers and 47.7% are symptomatic).[3] In the second Spanish focus of the disease, in Valverde del Camino, in Huelva (population of 12 780 according to census data from 2018), prevalence is one case per 600 population. Three cases were recently described in the Basque Country (2 from Gipuzkoa and one from Biscay)[36]; years ago, one of the authors of the present article (SGR) examined a patient from Bilbao (Figure 6), which may be a third focus of FAP in Spain. Other isolated cases have been observed in several autonomous communities of Spain, which has resulted in the publication of consensus guidelines for the diagnosis and treatment of the disease.[37]

A study using single-nucleotide polymorphism and microsatellite genotyping demonstrated that the Val30Met mutations in Portugal, Majorca, and Japan are identical.[38] The mutation is thought to have first occurred in a founder in Póvoa de Varzim and Vila do Conde, in northern Portugal (probably a humble fisherman with *doença dos pezinhos*), and subsequently spread across the world, either due to geographical proximity, as in the case of Valverde del Camino,[C] or due to historical circumstance, through trade relations, migration, conquest, or religious missions.

Acknowledgements

We are grateful to Dr Pere Riutord Sbert, who generously gifted us a copy of *Evocació del Dr. Miquel Munar Ques* (Palma, 2020). We would also like to thank Vanessa Cisteré, of the Spanish Society of Neurology's Museo-Archivo Histórico, and María José Rebollo, librarian in charge of heritage at the Official College of Physicians of Madrid for their ever-efficient assistance in locating rare articles.

Conflicts of interest

The authors have no conflicts of interest to declare.

References

1. Adams D, Cauquil C, Labeyrie C. Familial amyloid polyneuropathy. Curr Opin Neurol. 2017;30:481-9.
2. Koike H, Ikeda S, Takahashi M, Kawagashira Y, Iijima M, Misumi Y, et al. Schwann cell and endothelial cell damage in transthyretin familial amyloid polyneuropathy. Neurology. 2016;87:2220-9.
3. Buades Reinés J, Ripoll Vera T, Usón Martín M, Andreu Serra H, Company Campins M, Diéguez Millán JM, et al. Epidemiology of transthyretin-associated familial amyloid polyneuropathy in the Majorcan area: Son Llàtzer Hospital descriptive study. Orphanet J Rare Dis. 2014;9:29-35.
4. Bruns. Familialer symmetrischer Gangrän und Arthropathie an den Füssen. Neurol Centralblatt. 1903;22:599.
5. Fernández Sanz E. Lepra máculo-anestésica. Diagnóstico diferencial con la siringomielia. Rev Esp Med. 1909;12:97-108.
6. Fernández Sanz E. Siringomielia y púrpura. Rev Esp Med. 1909:217-24.
7. Guillain G, Dubois J. Sur une affection mutilante des extrémités inférieures. La valeur sémiologique du signe de Argyll-Robertson. Ann Med. 1914;1:553-8.
8. Bureau Y, Barriè, Kerneis J-P, De Ferron. Acropathies úlcero-mutilantes pseudo-syringomyéliques non familiales des membres inférieurs (à propos de vingt-trois observations). Presse Med. 1956;94:2127-32.
9. Alberca R, Albert P, Arjona V, Miranda-Nieves G. Sporadic acrodystrophic neuropathy. J Neurol Sci. 1973;20:85-95.
10. Barraquer Ferré L, De Gispert Cruz I. Dificultades diagnósticas en algunas formas de lepra, siringomielia y sífilis medular. Clínica y Laboratorio. 1943;35:478-85.
11. Albert Lasierra P, Sánchez Arroyo J. El mal perforante plantar. Consideraciones sobre su etiopatogenia y tratamiento. Rev Clin Esp. 1958;68:294-301.
12. Lassman LP, James CCM. Lumbosacral lipomas: critical survey of 26 cases submitted to laminectomy. J Neurol Neurosurg Psychiatr. 1967;30:174-81.
13. Nélaton A. Affection singulière des os du pied. Gazette des Hôpitaux Civils et Militaires. 1852;4:13.
14. Guillain G, Thévenard A. Mal perforant plantaire familial. Syringomyélie lombo-sacrée probable chez deux fréres. Ann Méd. 1929;25:267-74.
15. Thévenard A. L'acropathie ulcéro-mutilante familiale. Rev Neurol. 1942;4:193-212.
16. Thévenard A. L'acropathie ulcéro-mutilante familiale. Acta Neurol Belg. 1953;53:1-8.

[C]In the 1970s, the neurologist Gonzalo Moya researched the possible presence of Spanish cases of FAP in villages near the Portuguese border. He wrote to physicians practising in communities near the border, describing the presentation of the disease. He received no positive response, and the study therefore was not published.

17. Thévenard A, Coste M. Syringomyélie lombo-sacrée familial probable et spina-bifida occulta. Rev Neurol. 1935;1:195-206.
18. Garcin R. André Thévenard (1898-1959). Presse Med. 1959;67:2041.
19. Barraquer Ferré L, De Gispert Cruz I. Die Syringomyelie, eine familiäre und hereditäre Krankheit (13 Falle in 2 Generationen der selben Familie). Dtsch Z Nervenheilkd. 1936;141:146-57.
20. Balcells M, Cisteré V. The founding of the Spanish Society of Neurology (1949) in its international context. Neurosci Hist. 2013;2:94-100.
21. Barraquer Ferré L, Barraquer Bordas L. Altérations trophiques des pieds dans les affections acquises de la queue de cheval. Contribution personnel et revue de la littérature. Acta Neurol Belg. 1953;53:72-81.
22. Shedge R, Krishan K, Warrier V, Kanchan T. Postmortem changes. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 [accessed 2 Apr 2020]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK539741/
23. Denny-Brown D. Hereditary sensory radicular neuropathy. J Neurol Neurosurg Psychiatry. 1951;14:237-51.
24. Hicks EP. Hereditary perforating ulcers of the foot. Lancet. 1922;5138:319-21.
25. Baeck E. Ludo van Bogaert (1897-1976) and the Bunge Institute. Eur J Neurol. 2005;12:181-8.
26. Andrade C. A peculiar form of peripheral neuropathy. Familial atypical generalized amyloidosis with special involvement of the peripheral nerves. Brain. 1952;73:408-27.
27. Munar-Qués M, Saraiva MJM, Viader-Farré C, Zabay-Becerril JM, Mulet-Ferrer J. Genetic epidemiology of familial amyloid polyneuropathy in the Balearic Islands (Spain). Amyloid. 2005;12:54-61.
28. Barraquer-Bordas L, Peres-Serra J, Grau-Veciana JM, Martí Villalta JL. La obra y la vida científica de Barraquer-Ferré. Anales de Medicina y Cirugía. 1972;5:302-24.
29. Arboix A. The life's work of Dr. Luis Barraquer Ferré and its impact on the emerging Catalan school of neurology. Neurosci Hist. 2015;3:85-8.
30. Arboix A. El Dr. Ignasi de Gispert i Cruz (1903-1984): talento, fuerza de voluntad y erudición. Neurosci Hist. 2017;5:123-7.
31. De Gispert I. Memòries d'un neuròleg que fou metge de batalló. Barcelona: Editorial Selecta; 1976.
32. Munar-Qués M. Puesta a punto sobre amiloidosis. La amiloidosis hereditaria. Med Clin (Barc). 1994;103:109-15.
33. Munar-Qués M. Enfermedad de Corino Andrade. An R Acad Nac Med (Madr). 1999;116:681-2.
34. Buades-Reinés J, Raya-Cruz M, Gallego-Lezaún C, Ripoll-Vera T, Usón-Martín M, Andreu-Serra H, Cisneros-Barroso E. Transthyretin in familial amyloid polyneuropathy (TTR-FAP) in Mallorca: a comparison between late- and early-onset disease. J Periph Nerv Syst. 2016;21:352-6.
35. Barraquer Ferré L. Estudios de neurología clínica. Barcelona: José Janés Editor; 1952. Siringomielia; p. 478-85.
36. Andrés N, Poza JJ, Martí Massó JF. Polineuropatía amiloidótica familiar por mutación Val50Met (Val30Met) en el gen de la transtirretina. Neurología. 2018;33:585-9.
37. García-Pavía P, Muñoz-Beamud F, Casasnovas C; en representación del Grupo de Estudio y Tratamiento de la Polineuropatía Amiloidótica Familiar por Transtirretina (GETPAF-TTR). Recomendaciones para el diagnóstico y tratamiento de la polineuropatía amiloidótica familiar por transtiretina. Med Clin. 2015;145:211-7.
38. Ohmori H, Ando Y, Makita Y, Onouchi Y, Nakajima T, Saraiva MJM, et al. Common origin of the Val30Met mutation responsible for the amyloidogenic transthyretin type of familial amyloidotic polyneuropathy. J Med Genet. 2004;41:3-5.