

The Italian contribution to the anatomo-clinical method and physical examination in the history of neurology

Francesco Brigo¹, Mariano Martini², Lorenzo Lorusso³

¹Department of Neurology, Hospital of Merano (SABES-ASDAA), Italy; ²Department of Health Sciences, University of Genoa, Italy; ³UOC Neurology and Stroke Unist, ASST Lecco, Merate, Italy

Abstract. In Italy, neurology was constituted as a distinct and autonomous field only at the end of the 19th century. The recent neurological advances made in France were rapidly introduced and widely discussed among the Italian scientific community. The anatomo-clinical method applied by Jean-Martin Charcot (1825–1893) and his pupils to neurological disorders was immediately accepted and further refined by the Italian physicians. This led to important contributions to the physical examination with the description of new signs and tests for the diagnosis of various neurological disorders.

Keywords: Italy, neurology, history of Neurology

IL CONTRIBUTO ITALIANO AL METODO ANATOMO-CLINICO E ALL'ESAME OBIETTIVO NELLA STORIA DELLA NEUROLOGIA

Riassunto. In Italia la neurologia clinica si costituì come una branca autonoma e distinta solamente alla fine del XIX secolo. Le recenti scoperte e gli avanzamenti in ambito neurologico realizzati in Francia furono introdotti rapidamente e ampiamente discussi nella comunità medico-scientifica italiana. Il metodo anatomo-clinico applicato da Jean-Martin Charcot (1825–1893) e dai suoi allievi alla Neurologia fu prontamente accettato e ulteriormente adattato e rifinito dai medici italiani, portando a rilevanti contributi alla semeiologia neurologica, con la descrizione di nuovi segni tuttora utili per la diagnosi di malattie neurologiche.

Parole chiave: Italia, Neurologia, Storia della neurologia

Introduction

At the end of the 19th Century, Paris was the center of the neurological world, and Jean-Martin Charcot (1825-1893) was the leading figure in the field of neurology (1,2). The French master had developed and applied the anatomo-clinical method to the study of neurological disorders, an achievement that can be regarded as his greatest and most enduring legacy (3). Nowadays, neurologists continue to use this method: based on a detailed clinical history and physical examination, in most cases they can identify with utmost precision the location of the lesion(s) responsible for patients' symptoms.

In this article we provide a succinct overview of the Italian contribution to the anatomo-clinical method and physical examination in neurology, emphasizing the initial influence of Charcot and his pupils, and the original role played by several Italian physicians in the description of new signs and tests for the diagnosis of various neurological disorders.

Learning from the Master: Italian physicians and Jean-Martin Charcot (1825-1893)

Several Italian physicians at the turn of the 19th Century moved to Paris to study under Charcot and

his pupils, attending the famous lessons given by the French neurologist at La Salpêtrière Hospital in Paris (4). During their stay they took notes and once they came back to Italy translated these memories into Italian and published them. In doing so, they greatly contributed to the early dissemination of the most recent development in the field of clinical neurology across Italy. Furthermore, these translations provide information that cannot be found elsewhere in Charcot's corpus of works, and therefore are an invaluable and unique source to fully understand some of the ideas and theories proposed by Charcot (4).

In 1884, the famous Italian physician Gaetano Rummo (1853–1917) published the Italian translation of all lectures on aphasia delivered by Charcot in the summer of 1883, which represents the only complete collection of these lessons, and includes the first reproduction of the “Charcot's bell” diagram, showing the centers involved in language production (5). Charcot himself wrote the preface to the volume, praising the efforts made by Rummo in his work of translation and dissemination. In 1890, Rummo published a book with a series of 70 photos depicting the “Great Hysteria” or “hystero-epilepsy”, paying an explicit homage to the four sequential phases of hystero-epilepsy described by Paul Richer (1849–1933) and Charcot (6). Just like his master, Rummo practiced hypnotic therapy in Naples and was a pioneer in the use of video and phonograph to document animals and patients with various neurological disorders.

A further Italian physician, Domenico Miliotti (1851–1888), attended all the “Friday lectures” given by Charcot in the academic year 1883/1884, translated them into Italian, and published them in 1885 (7). He greatly praised the practice-oriented teachings by Charcot (that he called “*lezioni di cose*”, lessons by (or about) things). Some of the topics discussed at length and in detail in these lessons include hysterical sleep (“*attacco di sonno*”, sleep attack), “music aphasia” and “music agraphia” without verbal aphasia, Friedreich's ataxia, and prolonged hysterical fits (“*stato di male istero-epilettico*”, hystero-epileptic status).

Giulio Melotti (1857–?) also studied at La Salpêtrière under Charcot from 1884 to 1886, making some transcriptions of his lectures that cannot be found elsewhere (8,9). They include lectures on intermittent

claudication, convulsive tics with coprolalia and echolalia, and other selected topics.

The fascination exerted on Italian physicians by Charcot and his school persisted also beyond his death and continued to attract people eager to acquire extensive clinical learning on neurological disorders. Among them, one should mention the fascinating figure of Vincenzo Neri (1880–1960), who became a close friend of Charcot's pupil Joseph Jules François Félix Babiński (1857–1931), and a pioneer in the use of the cinematograph in neurology (10).

The Italian contribution to the physical examination in neurology

As surprising as it might be, neither Charcot nor his pupil Babiński ever published a systematic textbook on the anatomo-clinical method and the physical examination in neurology. The earliest book entirely devoted to these issues was published in 1889 by Leonardo Bianchi (1848–1927) to provide a practice-oriented description of neurological semiology for physicians and medical students (11). It describes the full spectrum of neurological examination in detail starting from neurological signs and presenting them according to the underlying neuroanatomical lesions. With its eight chapters, each devoted to a specific symptom/sign, this book provides a detailed description of each symptom/sign, enriched by useful tips to improve clinical examination, and a concise overview of underlying anatomical substrates (12).

As this example clearly shows, neurological advances made in France were rapidly introduced and widely discussed in the Italian scientific community. Italians were ready to rapidly accept and refine the anatomo-clinical method applied by Charcot and his successors, recognizing its clinical usefulness in identifying and diagnosing various neurological disorders. Furthermore, they described new signs and were able to provide detailed and accurate explanations of their underlying mechanisms.

Of note, major contributions of Italian physicians to the neurological examination were devoted to clinical disorders arising as a consequence of a pyramidal tract dysfunction. The pyramidal tract, first

described in detail by Ludwig Türck in 1852 (13), is a motor pathway including fibers that carry signals from the motor areas of the cortex, where the cell bodies of the upper (or first) motoneurons are located, to the brainstem or spinal cord, where axons of these cells eventually make synaptic connection with the lower (or second) motoneurons.

In 1896, Babiński had very succinctly described a sign to detect a pyramidal tract dysfunction (14). This sign, widely known as the Babinski sign or extensor toe sign, is elicited by stroking along the lateral border of the foot sole: this stimulation leads to an upward movement of the big toe (dorsal flexion). This phenomenon is commonly found in newborns and infants, and subsequently disappears as a consequence of inhibition from upper neuronal centers (15). After one year of age, the normal response to stimulation of the foot sole is a downward movement (flexion) of the big toe. Conversely, a dorsal flexion of the big toes (Babinski sign) is invariably a sign of pyramidal tract dysfunction (Figure 1).

Just three years after its first description, between the 26th and 28th of June 1899, a series of meetings were held in Naples, where some Italian physicians discussed at length the clinical value of the Babinski sign.

Giovanni Boeri (1867–1946) reported having found this sign in 76% of patients with acute or chronic hemiplegia (16). It was absent in some patients with muscular atrophy and amyotrophic lateral sclerosis but was invariably found in Erb-Charcot paralysis (spastic paraplegia due to syphilitic meningomyelitis). Furthermore, in cases of traumatic myelitis affecting the upper segments of the spinal cord, it could be absent. Based on our current knowledge, we now know that the Babinski sign can lack in patients with a spinal shock due to the temporary inexcitability of spinal motor neurons. Furthermore, as Boeri himself pointed out, the Babinski sign can be elicited only if the peripheral nerves and muscles mediating the reflex are intact (16). Hence, immediately after its description, it was recognized that this sign has a suboptimal sensitivity to detect a pyramidal tract dysfunction, and it needs to be interpreted considering the whole clinical picture (17).

Concerning its specificity, during a lecture given

on 1st July 1899 at a meeting of the Lancisian Society of the Hospitals of Rome, Vincenzo Giudiceandrea (dates unknown) claimed that the Babinski sign could be observed «in cases where one cannot suspect a lesion of the pyramidal pathways (hysteria); conversely, in some cases, where such a lesion certainly exists, the normal movement of flexion can occur» (18). Nowadays, we know that the Babinski sign has a very high specificity for pyramidal tract dysfunction. The incorrect criticisms raised by Giudiceandrea were probably due to very few details on how to evoke correctly the sign in clinical practice (the first description provided by Babiński in 1896 was extremely succinct and could leave room for uncertainty).

During the same meeting in Rome, the famous Italian physician Giovanni Mingazzini (1859–1929) provided what remains the most appropriate interpretation of the mechanisms underlying the Babinski sign (18).

As he noted, «The movement of toes following the stimulation of the foot sole could be regarded as part of a set of automatic movements involving upward flexion of the foot and flexion of the leg and thigh, rather than as a real reflex». Mingazzini mentioned the flexor synergy of the lower limb following plantar stimulation that had been first described by Édouard Brissaud (1852–1909) in 1896 (19). As Mingazzini correctly understood, the Babinski sign is a complex series of motor phenomena that are found in newborns and infants, but are later masked by inhibition from upper neuronal centers. However, this central motor pattern remains rooted in the central nervous system and can reemerge after a pyramidal system dysfunction (20).

In the following years, other physicians provided alternative methods or described new signs to detect a pyramidal tract dysfunction.

In 1912, Camillo Negro (1861–1927), an important Italian neurologist at the turn of the 19th Century and a pioneer in the use of video recordings in neurology (21,22), observed that when the patient lying in dorsal decubitus position raises the paretic limb with the leg extended on the thigh, there occurs an upward movement of the big toe, which is entirely consistent with the Babinski sign (23). This method clearly shows that the Babinski sign cannot simply be regarded as an

exteroceptive reflex following the stimulation of a bodily surface, but it can be evoked also by the activation of proprioceptive pathways involving muscle contractions or tendon stretching (24). Furthermore, Negro described how cold could facilitate the appearance of the Babinski sign and proposed the use of (faradic) electrical stimulation to evoke it (24).

In 1913, in an article published in *Revue Neurologique*, Giovanni Mingazzini described two “*petits signes*” (“small signs”) or “*indices de luxe*” (“luxury clues”) to detect slight organic paresis (25). The first sign was the arm test, which he called “*signe du serment*” (“oath sign”). Nowadays, although the name of Mingazzini is widely forgotten, this sign continues to be used to detect a paresis due to a stroke (it is part of the so-called Face Arm Speech Test, FAST) and to objectively quantify the functional impairment following a stroke (it is part of the National Institutes of Health Stroke Scale or NIHSS). The second sign described by Mingazzini was the “orbiculo-palpebral

sign” (“*le signe de l’orbiculaire des paupières*”), which was proposed to detect the mild muscle impairment of the upper half of the face occurring in central facial palsy.

A further sign to identify pyramidal tract dysfunction was described by Vincenzo Neri in 1909 (26). He observed that «in a patient standing with the legs apart and the arms crossed on the chest if one makes him bend his trunk on his pelvis, telling him to hold straight his legs, one observes that at a certain moment (when the trunk has almost reached the horizontal line) the leg on the paralyzed side flexes on a certain degree, whereas the unaffected leg remains extended». According to Dimitrie Noica (1869-1937), this sign reflects spinal hyperfunction emerging after a pyramidal lesion (27). Hence, it should be interpreted as a part of a triple flexion reflex (“*mouvement de défense*”, “defensive movement”), the shortening of the extremity, with flexion at the hip and knee and dorsiflexion at the ankle, that occurs after stimulation of the lower limb in patients with pyramidal tract lesions (10). After the acute lesion, the sign described by Neri could reflect an unusual pattern of flexor spasticity of the lower extremity, which was described in detail only in 1935 (28).

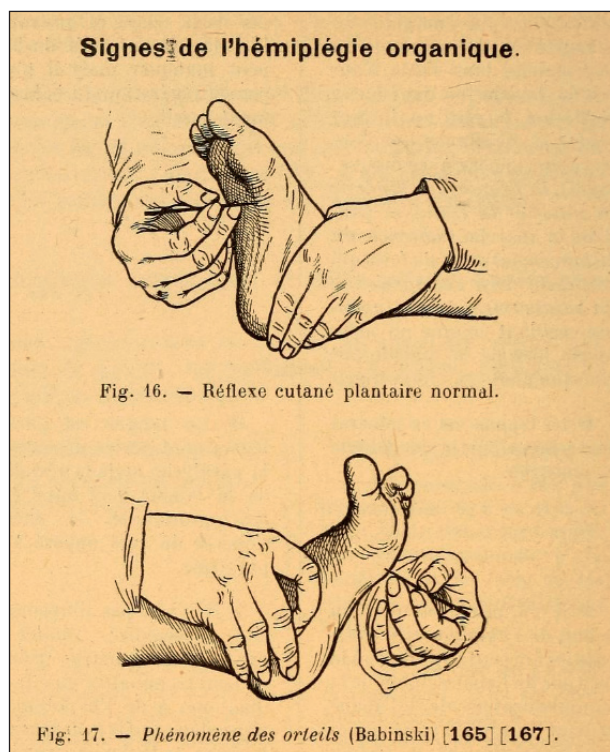


Figure 1: Drawings illustrating the normal toe phenomenon (upper figure) and the Babinski sign (lower figure). From: Babinski J, Froment J. *Hystérie-pithiatisme et troubles nerveux d’ordre réflexe en neurologie de guerre*. Paris: Masson et Cie; 1917 pag. 178

Conclusions

In Italy, neurology emerged as a distinct and autonomous field at the end of the 19th century (29,30). Neurological advances made in France were rapidly introduced and widely discussed among the Italian scientific community, which accepted and refined the anatomo-clinical method applied by Jean-Martin Charcot and his pupils. Many Italian physicians provided relevant contributions in the refinement of the physical examination and in the description of new signs and tests that retain their clinical value for the diagnosis of various neurological disorders.

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Correspondence:

Mariano Martini

Department of Health Sciences, University of Genoa, Italy

E-mail: mariano.yy@gmail.com