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Lessons from the past

Antoine-Barthélemy Clot, known as Clot-Bey (1793–1868), and spinitis in 1820

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INFO ARTICLE

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Historians know Antoine-Barthélemy Clot (1793–1868) for his long stay in Egypt in the entourage of Muhammad Ali Pasha (1769–1849), who took power after France's inglorious withdrawal in 1801. In the 1830s, Clot became an unofficial diplomat under King Louis-Philippe (1773–1850) for dealings with this new Egyptian leader [1]. A recent biography can be consulted, providing details on the oriental adventures of this physician from Marseille [2]. Here we intend to highlight the doctoral thesis in medicine that Clot defended on 24 July 1820 in Montpellier: *Recherches et observations pathologiques sur le spinitis ou inflammation de la moelle épinière* (*Pathological research and observations on spinitis, or inflammation of the spinal cord*) [3], which can be considered the first research on spinal pathology in France. Charles-Prosper Ollivier d'Angers (1796–1845) [4] drew inspiration from this thesis when he wrote his famous work, *Traité de la moelle épinière et de ses maladies* (*Treatise on the spinal cord and its diseases*), in 1827, which was published in multiple editions [5]. Clot was clearly unaware that, two years before his thesis, the Scottish John Abercrombie (1780–1844) published an extensive study on various aspects of spinal cord inflammation and infection, as well as meningeal and spinal cord haemorrhage [6].

1. Brief biography of Antoine-Barthélemy Clot

Clot was born in Grenoble on 07 November 1793 (Fig. 1). His father was a non-commissioned officer in the army stationed in Italy who had to return to France for treatment of the injuries he sustained in the Battle of Marengo (14 June 1800). The military physician Philibert Constant Sappey (1778–1860) treated him until his death in 1811. Having taken a liking to the son of this valorous soldier, he saw to Clot's initial training in surgery at the Hôtel-Dieu de Brignoles, a hospital in southeastern France, which led to Clot's medical vocation. In 1813, he enrolled at the medical school in Marseille [1,2,7]. Admitted on 30 January 1816 as a surgery resident, prior to being qualified as a physician, he rose to the position of civil Health Officer on 30 September 1817. However, to become an official physician, he had to pass his baccalaureate test, which he did in Aix-en-Provence in 1819, a necessary step prior to defending his thesis the following year. After undergoing additional training, he rose to the position of Doctor of Surgery on 18 January 1823. Upon returning to Marseille, he was appointed physician at Hôpital de La Charité and surgeon at

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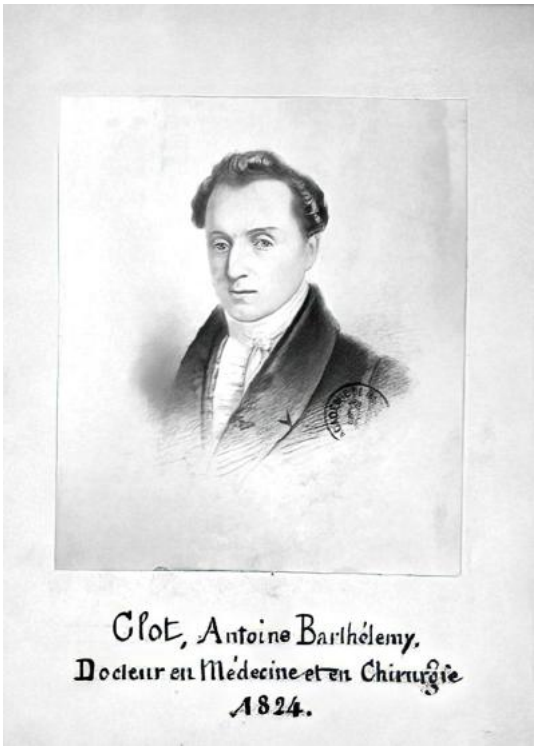


Fig. 1 – Portrait of Antoine Clot in 1824 (© French National Academy of Medicine).

Hôpital des Orphelines. In 1825, after having come across his superior and a patient engaged in an intimate act that was clearly untherapeutic and intolerable in a hospital run by Catholic authorities, he was the target of a retaliatory conspiracy that led to his dismissal from his hospital duties [1,2]. By chance, it was at this time that he met an envoy of the Egyptian pasha who was looking for physicians and surgeons. Clot was tasked with founding a hospital and a medical school, with the mission of treating the formidable army that enabled Muhammad Ali Pasha to remain in power. Clot set up training for physicians and nurses and had several hospitals built, the most well-known of which was the Abou-Zabel hospital north of Cairo [7]. In 1832, Clot led several Egyptian students to appear before the French Academy of Medicine to show the successful results of his oriental enterprise, resulting in regular exchange between students from both countries. One of his most valuable innovations was the creation of a maternity ward and a school for midwives in spite of strong local prejudices. Paradoxically, there was no such school in France at that time. Clot introduced vaccination in Egypt and studied the contagiousness of the plague, ophthalmia (trachoma), and cholera, the efficacy of quarantines, etc. [8]. To thank him for all his work, Muhammad Ali Pasha honoured him with the title of *bey* in 1832, which he added to his family name, becoming Antoine-Barthélemy Clot-Bey for posterity. In 1849, after the death of his patron, Clot returned to Marseille but was called back to Egypt in 1856 by the successor Mohamed Saïd Pasha (1822–1863). Clot-Bey's numerous writings, available in the library of the French Academy of Medicine and in the French National Library, provided Adrien Proust (1834–1903) with epidemiological data on cholera and the plague which he used to develop his project for "an international office of public health", forbearer of the World Health Organisation [9]. In 1860, Clot also became interested in the project to build the Suez Canal and in the health problems he foresaw [10]. Retiring in Marseille in 1860, Clot-Bey died on 28 August 1868 after repeated strokes [11]. Marseille and Grenoble pay homage to this physician with an avenue and a street named after him, but unfortunately his name is sometimes misspelled as "clôt Bey", which in French evokes the enclosed garden of mister Bey! [1,2].

2. Pathological research and observations on spinitis, or inflammation of the spinal cord

It must be remembered that only after 1750 did physicians adopt a paradigm in which disease was localised anatomically, and lesions were related to symptoms and vice versa. By the end of the 18th century, two Edinburgh physicians, Charles Bell (1774–1842) and Marshall Hall (1790–1857) and the French François Magendie (1783–1855) had contributed to the advancement of knowledge about the spinal cord. Descriptive anatomy was already quite precise but vertebral lesions, especially traumatic lesions, could not be accurately assessed, at least while patients were alive [12].

Clot followed in the footsteps of those who adhered to the precepts put forth by François Joseph Victor Broussais (1722–1838). This orientation was viewed very unfavourably by his former professors at the medical school in Montpellier, who had always negated the theory of universal inflammation to explain pathology and who had fought against its corollary, the practice of bleeding and its abuses [13].

From the start of his writings on the subject, Clot noted that "for too long, we have neglected both the physiology and the pathology of the spinal cord. Hidden in a deep cavity and difficult to observe, this organ has rarely been examined in the autopsy of cadavers". He went on to marvel at the functional anatomy of the vertebral canal, which allows flection and extension without ever compressing the spinal cord. He urged his readers to consider the spinal cord and brain as a unit, given "the utmost similarity" between them. According to him, the works of the anatomists he had read, without citing them, distinguished between these two structures, which they considered separate, without recognising their functional continuity. He did not see in the spinal cord "the fibrils as in all nerves" but rather "a pulpy material, completely identical throughout with the substance of the brain". He considered the two halves of the spinal cord as similar to the two hemispheres. He noted the likeness of the macroscopic appearance of the spinal cord and the brain, each consisting of white matter and grey matter: "Whatever the organisation of these two substances and their respective functions, they are found in the spinal cord, which demonstrates that this organ should not be considered as a simple nerve but as an integral part of the nervous centre". He also noted that "the spinal cord, like the brain, distributes nerves" and in even greater numbers. To demonstrate his understanding of the brain-spinal cord unit as functioning "as a nervous centre", he established a similarity between the two hemispheres and

''the spinal cord, which is divided into two small masses or cords linked by an intermediary ribbon''.

Clot referred to the vivisection experiments performed by the Florentine Felice Fontana (1730–1805), César-Julien Legallois (1770–1814), and the British Benjamin-Collins Brodie (1783–1862) to understand the physiological functions of the spinal cord. A section at the top of the spinal cord allows for autonomic motor activity in the limbs, but a lesion specifically in the medulla oblongata results in immediate death by stopping the heart and the breathing. To validate the results of these predecessors, Clot also experimented with vivisection. He concluded: ''Lesions in the spinal cord are more dangerous than in the brain, leading to the conclusion that it is more necessary to vital functions than the brain itself''. He did not clearly indicate at what level he had damaged the spinal structures but he confirmed Legallois's 1812 assertions that ''the pons is the main location of the vital function'' [14]. He deduced the following: ''It is proven that the higher the damage to the spinal cord, the more dangerous it is, because the spinal cord envelops the origin of the intercostal nerves for the dorsal part, the diaphragmatic nerve for the cervical part, and then the vagus nerve and large sympathetic nerve. Thus, in lesions of the spinal cord by concussion, compression, a wound, etc., death is more imminent when the lesion is higher up''. He gave this example: ''The dislocation of the odontoid apophysis is potentially fatal'', and also cited cervical Pott's disease. Clot also did not fail to note the ''border between insensitive skin and sensitive skin, always at the height of the diseased vertebra and of the origin of the compressed nerve''. For him, each spinal level had functional autonomy: ''All the parts are equal in their prerogatives''; but at the same time, the parts communicate between themselves, meaning that ''a lesion in one of them spreads very easily to the entire centre and consequently to the entire economy''.

Clot then tried to enumerate the nerves originating in the brainstem to which he added some symptoms of deficits making it possible to attribute a lesion specific to each one: ''These nerves are very close to each other; it is apparent that the lesions in these parts must be very serious and compromise many organs and functions at once... This explains why, in our opinion, the lesions at the base of the brain, and notably in this region, cause such a sudden death''. He concluded that the lesions in the hemispheres are less fatal than those in the ''medulla oblongata'', notably those around the origin of the vagus nerve, for him the eighth cranial pair. In addition to the dislocation of the odontoid apophysis due to trauma, a number of poisons, but also the rabies virus, act, according to him, by blocking the activity of the nerves of the brainstem, which are necessary for cardiac and respiratory functions.

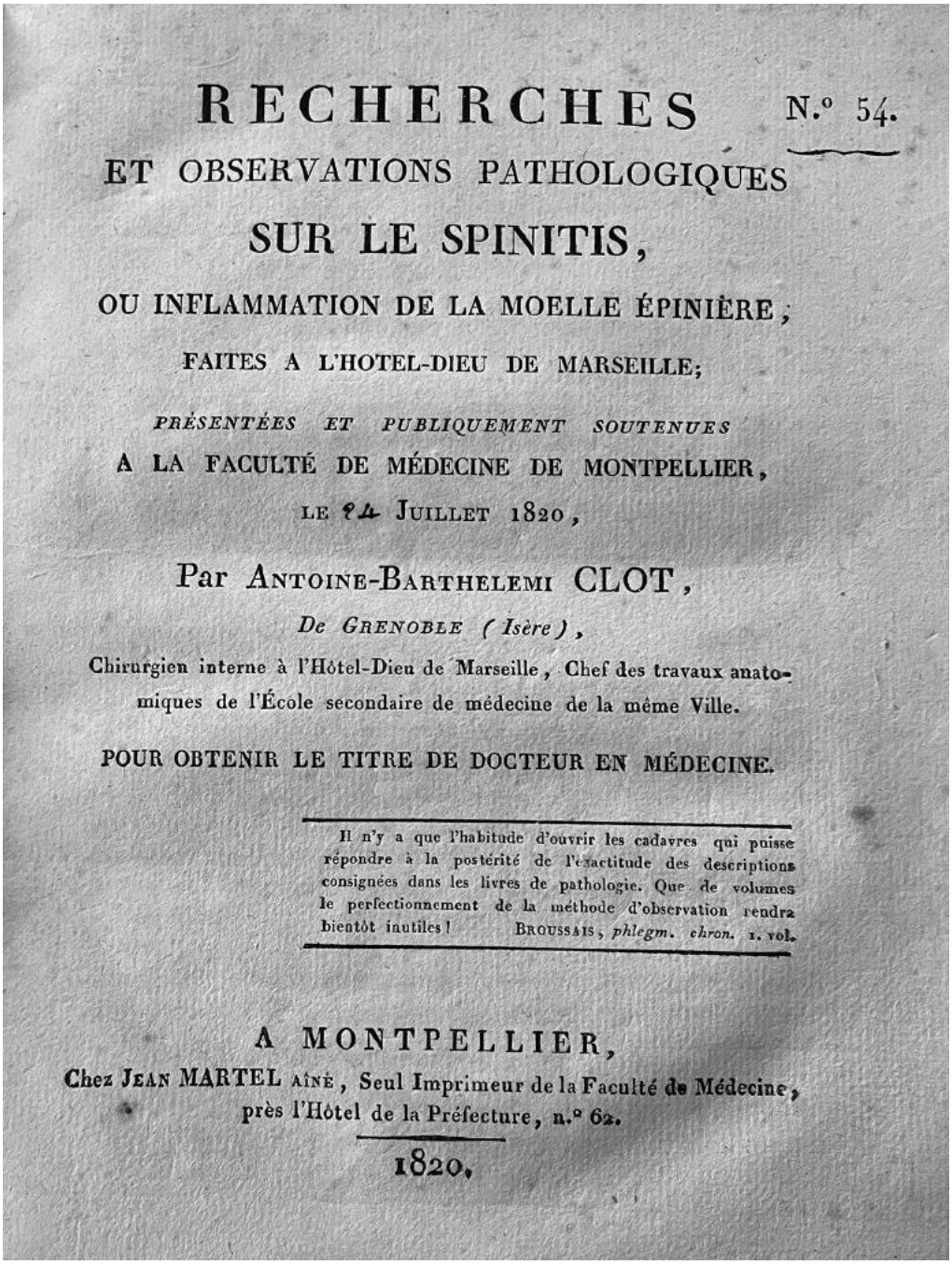
3. What is spinitis?

Clot described symptoms of what he called ''spinitis'' (Fig. 2). Setting in rapidly with fever or more slowly, ''paralysis in the limbs, swelling of the belly, the accumulation of urine in the bladder'', and pain ''along the spine'' characterised, for him, a disease of the spinal cord. He distinguished between a slow progressive onset with paralysis and cases where it was complete and immediate even though, in all cases, during autopsy he found pus and bone lesions, which he linked explicitly to Pott's disease [15]. He admitted he could not distinguish between damage to the spinal substance and damage to the meninges but nonetheless suggested attributing the paralysis to damage to the spinal cord and in its absence to isolated damage to the meninges. He then localised the height of the damage depending on the limbs paralysed or subject to convulsions. Urine retention indicated lower damage. Recovery was exceptional. He often observed fever, which he associated with suppuration giving way to ''gangrene of the spinal cord''. His proposed therapies were limited to fasting, repeated bleeding, and the application of leeches. Most of the reported cases presented with contractions in the limbs and sometimes opisthotonos, which led Clot to view tetanus as ''phlegmasia of the spinal cord''. Clot noted that ''the colic of Poitou'' (lead poisoning) could accompany paraesthesia then paralysis of the limbs [16]. Once again, he attributed these symptoms to damage to the spinal cord.

Two of Clot's observations are particularly noteworthy. In a 23-year-old man and in another man aged 31, ''a feeling of torpor in the feet and legs'' set in very rapidly, with urine and stool incontinence and decreased sensitivity. The rapid progression lasting a few days was marked by progressive ascension of the paralysis successively affecting the lower limbs, then the upper limbs, and finally the thoracic muscles, resulting in death by asphyxia with ''memory and speech intact'' until the final moments. Did Clot describe really two cases of the syndrome associated with the name of Octave Landry (1826–1865) in 1859 [17,18] and that of Georges Guillain (1876–1961), Jean-Alexandre Barré (1880–1967), and André Strohl (1887–1977) in 1916? [19]. Sphincterian incontinence might be a reason to discuss this interpretation.

It should also be remembered that after Clot, Auguste-François Chomel (1788–1858) described an epidemic that took place in spring of 1828 in Paris, which is often cited as the first description of the syndrome. Patients complained of ''numbness and a loss of the sense of touch, which in some cases was quite extensive. Several patients were unable to tactilely distinguish another body, or a key, for example, from a pair of scissors. They were totally impaired... Walking took on a particular characteristic: the foot flat on the ground did not cling to it and instead had to be lifted like an inert mass with its point constantly dragging... Several patients were entirely unable to move'' [20].

Among the causes of ''spinitis'', Clot enumerated falls on the spinal column and ''little known symptomatic causes that are nonetheless far more numerous than others''. He mentioned gout, erysipelas, an exanthem, and ''excessively partaking in the pleasures of love and masturbation''. For him, the diagnosis applied when the following existed: ''Pain along the spine, intense heat in the skin, extreme emotional depression, and convulsive movements in the limbs''. He then completed the clinical picture with paralysis in the limbs and initial urine retention, followed by definitive incontinence. There was never ''damage to the intellectual faculties''. The symptoms rarely regressed and, in most cases, paralysis in the respiratory muscles led to death within a few days. Clot concluded his thesis by trying to establish a causal link between ''spinitis'' and tetanus, epilepsy, and rabies.



RECHERCHES N.° 54.

ET OBSERVATIONS PATHOLOGIQUES

SUR LE SPINITIS,

OU INFLAMMATION DE LA MOELLE ÉPINIÈRE;

FAITES A L'HOTEL-DIEU DE MARSEILLE;

PRÉSENTÉES ET PUBLIQUEMENT SOUTENUES

A LA FACULTÉ DE MÉDECINE DE MONTPELLIER,

LE 24 JUILLET 1820,

Par ANTOINE-BARTHELEMI CLOT,

De GRENOBLE (Isère),

Chirurgien interne à l'Hôtel-Dieu de Marseille, Chef des travaux anatomiques de l'École secondaire de médecine de la même Ville.

POUR OBTENIR LE TITRE DE DOCTEUR EN MÉDECINE.

Il n'y a que l'habitude d'ouvrir les cadavres qui puisse répondre à la postérité de l'exactitude des descriptions consignées dans les livres de pathologie. Que de volumes le perfectionnement de la méthode d'observation rendra bientôt inutiles! BROUSSAIS, *phlegm. chron.* 1. vol.

A MONTPELLIER,

Chez JEAN MARTEL AÎNÉ, Seul Imprimeur de la Faculté de Médecine, près l'Hôtel de la Préfecture, n.° 62.

1820.

Fig. 2 – Cover of the thesis of AB. Clot-Bey (OW Collection).

At the time Clot was defending his thesis, there was only one predecessor in France, a doctoral student named Louis Jean-Baptiste Desfray (1778–1853), future surgeon at the hospital in Blois, who defended his thesis in Paris on 16 December 1813: *Essai sur le spinitis ou inflammation de la moelle épinière* (*Essay on spinitis, or inflammation of the spinal cord*) [21]. Desfray's clinical descriptions resembled some of those of Clot, notably his descriptions of the spinal cord simultaneously damaged by vertebral bone degeneration, which he called Pott's disease. In 1827, Pierre Léon Crouzit (1802–?) would try in his thesis to further Clot's research, but his work is very confusing and holds little interest [22]. We can note his suggestion to attribute lead colic (lead poisoning) to damage to the spinal cord.

4. In conclusion

With the defence of his thesis, the young Antoine-Barthélemy Clot (Fig. 3) inaugurated a field of study previously uncharted in France, the study of spinal pathology. Apparent in his observations of pathologies that would currently be linked to

Fig. 3 – Clot-Bey, inspector general of the health department in Egypt (© BIUsanté, Université Paris Cité).

infection, notably tuberculous infection, his perspicacity as a clinician made it possible for him to describe two cases potentially comparable to those that, a century later, Georges Guillain, Alexandre Barré, and André Strohl would call ''a syndrome of radicular neuritis with hyperalbuminosis of the cerebrospinal fluid without cellular reaction''. Like the Scottish Abercrombie, Clot can be recognised as a pioneer in the study of spinal cord pathology [23].

Disclosure of interest

The author declares that he has no competing interest.

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