Spinal cord disease in the work of Jean Cruveilhier: a few little-known neurological gems

J. J. Zarranz

Emeritus chair. Department of Neuroscience. Universidad del País Vasco, Lejona, Vizcaya, Spain.

ABSTRACT

Introduction. Jean Cruveilhier (1791-1874) was a physician at several Parisian hospitals and the first chair of anatomical pathology. He created a vast body of work, with the key text being his *Anatomie pathologique du corps humain*, which may be considered a masterpiece of empirical medicine based on the anatomoclinical method. Despite including numerous descriptions of nervous system pathologies, neither the book nor its author have received the interest they deserve among neurologists.

Material and methods. All of the *livraisons* (submissions) of *Anatomie pathologique* that address spinal cord diseases were reviewed with a view to highlighting the interest of Cruveilhier's work for today's neurologists.

Results. After briefly summarising Cruveilhier's biography, I present the main findings regarding spinal cord diseases in his book, according to the classification that he proposes, highlighting his efforts to develop semiology in order to diagnose living patients. Cruveilhier was the first author to describe degeneration of the dorsal spinal roots and "grey degeneration" (multiple sclerosis), contributing the clinical symptoms of these patients.

Conclusion. Cruveilhier has undeservedly been forgotten, and should be considered an early proponent of neurology at the Salpêtrière, several decades before Charcot.

KEYWORDS

Cruveilhier, spinal cord, haematomyelia, spinal cord tumour, multiple sclerosis, Charcot

To those interested in the nervous system, Cruveilhier's Anatomie pathologique *is a storehouse of fascinating cases equalled only by Morgagni's* De sedibus. *The magnificent illustrations make the work unique in all the literature of pathology for clarity and accuracy of presentation as well as aesthetic appeal.*

Eugene S. Flamm

Introduction

These words from Flamm[1] masterfully synthesise the interest for neurologists, and for all physicians, of Cruveilhier's[2] anatomical pathology treatise (Figures 1 and 2). Most of the figures in his work *Anatomie pathologique du corps humain* are true works of art, not only because of the ability of the draftsman and engraver Antoine Chazal, but also due to the skill and originality of the anatomical preparations and the precise dissection of the pathological specimens. However, Cruveilhier went far beyond merely collecting images, as was the case with the majority of pathological atlases at the time. His submissions (*livraisons*) are individual instalments that were subsequently collected in two thick volumes, and

Corresponding author: Dr Juan José Zarranz
E-mail: jj.zarranz@hotmail.com

Received: 12 December 2020 / Accepted: 23 December 2020

Figure 1. Jean Cruveilhier. Portrait at the Bibliothèque Nationale de Médecine (lithograph signed by Maurir).

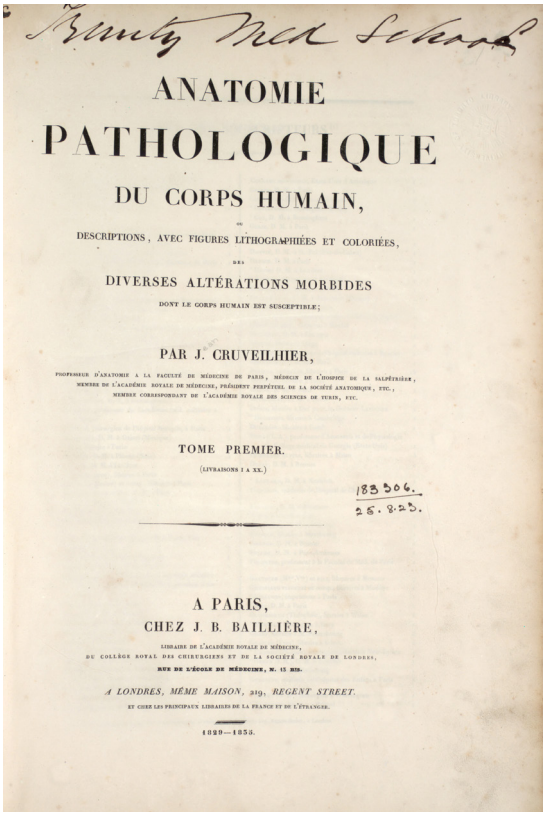

ANATOMIE
PATHOLOGIQUE
DU CORPS HUMAIN,
DESCRIPTIONS, AVEC FIGURES LITHOGRAPHIÉES ET COLORIÉES,
DES
DIVERSES ALTÉRATIONS MORBIDES
DONT LE CORPS HUMAIN EST SUSCEPTIBLE;
PAR J. CRUVEILHIER,
TOME PREMIER.
(LIVRAISONS 1 A XX.)
183506.
25.8.23.
A PARIS,
CHEZ J. B. BAILLIÈRE,
A LONDRES, MÊME MAISON, 219, REGENT STREET.
1829—1835.

Figure 2. First page of Cruveilhier's *Anatomie pathologique*.

are based on the author's own clinical and pathological cases.

Cruveilhier followed the tradition of empirical medicine based on evidence rather than speculation.[3] His method was the correlation of clinical symptoms and pathological findings, developed by Morgagni himself, to whom the quote above from Flamm[1] alludes. Cruveilhier summarised his thought in one of his famous phrases: "Les systèmes passent, les faits restent" ("dogmas fade, but facts remain").[3] Some of the great cultivators of the anatomoclinical method, precursors to Cruveilhier in Paris, were Olivier d'Anger, Bichat, and Laënnec, whom Cruveilhier probably surpassed in many respects, despite not achieving general recognition. In fact, he is overlooked in reference works on the history of medicine[1] and even by French authors, who mention him only as an anatomist, but do not include him among the pathologists or the clinical precursors of Charcot at the Salpêtrière.[4-6] In the field of diseases of the nervous system, the dominant figures of Charcot and Vulpian obscure all those who came before them at the Salpêtrière,[7-10] as though everything had begun with them. Cruveilhier has also been overshadowed by these figures, despite having preceded them by several decades both as a physician and as the first occupant of the chair of anatomical pathology, a position both men later held. This is surprising, as Charcot himself acknowledged that Cruveilhier's atlas "is an admirable book" and recommended it.[11]

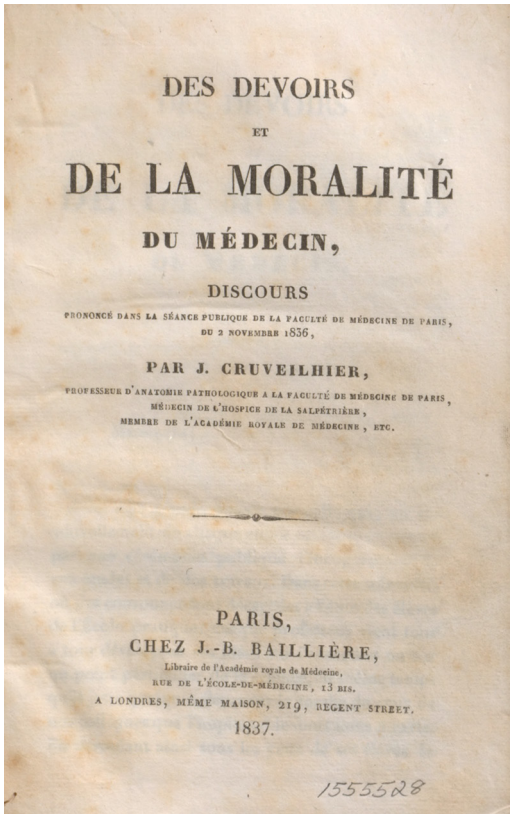
One recent author who did recognise the value of Cruveilhier's work was Spillane,[12] who described him as "the prince of these physician-pathologists" (in the area of neurology) and published an excellent review of neurological aspects of *Anatomie pathologique* in his

book *The doctrine of the nerves*. Walusinski and Poirier[13] also highlight Cruveilhier's interest in neurology, which he shared with nearly all of the subsequent chairs of anatomical pathology in Paris. They also acknowledge his great standing as a neuropathologist and describe his *Anatomie pathologique* as magnificent.

Cruveilhier constantly sought to establish relationships between clinical and pathological phenomena, and advocated that anatomy be combined with physiology and pathology. As if this were not enough, he was also a defender of the moral values of the physician, which he synthesised in a memorable speech at the beginning of the academic year at the Faculty of Medicine, a text that should be obligatory reading for all medical graduates (Figure 3).[14] It is a kind of renewed Hippocratic oath translated to the times of romantic-liberal individualist medicine.

Flamm[1] and Spillane[12] briefly summarise all the neurological aspects of Cruveilhier's *Anatomie pathologique*; in different submissions on diseases of the brain, he addresses apoplexy, tumours, idiocy, acute meningitis, tuberculoma, paediatric hydrocephalus, agenesis and malformations, cysticercosis, infarcts (*ramollissements*), etc. Both authors dedicate relatively extensive sections of their works to diseases of the spinal cord.

Other authors have discussed even more specific cases and aspects of *Anatomie pathologique*; for instance, Berhouma et al.[15] emphasise the wonderful descriptions of tumours of the base of the skull (epidermoid, meningiomas, and eighth cranial nerve schwannomas). Davis et al.[16] focus on hydrocephalus, Chiari malformation type II, and spina bifida, and Pearce[17] notes that Cruveilhier was the first to describe these diseases. There is a degree of controversy as to whether Cruveilhier or Carswell was the first to publish images of multiple sclerosis lesions[18-20]; this topic is addressed in an excellent review by Ruiz Ezquerro and Ruiz López.[21] However, there can be no doubt that Cruveilhier was the first to relate these findings with a clinical history suggestive of the disease, as was acknowledged by Charcot himself.[11] The clinical description of progressive muscular atrophy is attributed to Aran,[22] but it was Cruveilhier who published the first pathological description,[23,24] and the disease was soon recognised in Britain as atrophic palsy or Cruveilhier disease[25,26]; an eponym that has been reclaimed in recent years.[27] This is just one of nearly 20 eponyms attributed to Cruveilhier.[28] His description of several brain tumours has also been addressed in historical reviews.[29,30]


DES DEVOIRS

ET

DE LA MORALITÉ

DU MÉDECIN,

DISCOURS

PRONONCÉ DANS LA SÉANCE PUBLIQUE DE LA FACULTÉ DE MÉDECINE DE PARIS, DU 2 NOVEMBRE 1836,

PAR J. CRUVEILHIER,

PROFESSEUR D'ANATOMIE PATHOLOGIQUE A LA FACULTÉ DE MÉDECINE DE PARIS, MÉDECIN DE L'HOSPICE DE LA SALPÊTRIÈRE, MEMBRE DE L'ACADÉMIE ROYALE DE MÉDECINE, ETC.

PARIS,

CHEZ J.-B. BAILLIÈRE,

Libraire de l'Académie royale de Médecine,

RUE DE L'ÉCOLE-DE-MÉDECINE, 13 BIS.

A LONDRES, MÊME MAISON, 219, REGENT STREET.

1837.

1555528

Figure 3. First page of Cruveilhier's laudable speech on the moral values of the physician, with a phrase alluding to the courage of physicians in times of epidemics, which remains completely relevant today.

However, there is still room for a somewhat deeper and more valuable review of the cases Cruveilhier presents of spinal cord disease in his atlas. The book is recommended by none other than Charcot,[11] who highlights the clinical observations that are not included in other atlases and urges his own readers to study Cruveilhier's chapter on paraplegia. Without a doubt, the book contains some true neurological "gems," reflecting advanced knowledge of the anatomy and pathology of the spinal cord and the semiology of spinal diseases. For instance, Cruveilhier was able to suggest how to clinically distinguish between intrinsic injuries to the spinal cord and extrinsic spinal compression. However, he was still not sure of the role of the posterior columns, which he believed were involved

Table 1. Timeline of Jean Cruveilhier's life

1791. Born in Limoges. His father (Leonard), a surgeon, encouraged his son to be a physician, although his vocation was unclear.
1810. Studies medicine in Paris. His mentor was Guillaume Dupuytren, under whom he worked as an intern.
1816. Doctoral thesis in medicine. Works in Limoges as a rural physician (he does not become a surgeon at the hospital)
1819. Marries Marie Grellet. His son Pierre was also a physician. The couple had eight daughters.
1823. Returns to Paris. With Dupuytren's support he becomes a tenured professor of surgery in Montpellier.
1825. Professor of anatomy in Paris
1826. Médecin des Hôpitaux. Société Anatomique (president for 40 years)
1829. Chevalier de la Légion d'Honneur
1830. Chief physician at Hospice de la Maternité
1832. Head of service at the Salpêtrière (succeeding Rostan)
1835. Member of the Académie de Médecine (president in 1839)
1836. Chair of anatomical pathology in Paris (texts of *Anatomie pathologique du corps humain* and *Traité d'anatomie pathologique générale* published in 1828-1842 and 1849-1864, respectively)
1842. Officier de la Légion d'Honneur
1856. Médecin Honoraire
1863. Commandeur de la Légion d'Honneur
1866. Professeur honoraire
1874. Dies at his country estate in Sussac

in motor activity. This article seeks to address in greater detail some of these aspects.

Material and methods

Data for the brief biography of Cruveilhier are mainly taken from a range of online resources[31-36] and the study by Vayre,[3] who also provides his complete family tree. To identify the sections dedicated to diseases of the spinal cord, both volumes of *Anatomie pathologique* that are cited in the bibliography were reviewed.[2] Of these, comments are made on those that are of greatest interest from the perspective of general neurology, leaving aside several sections addressing spina bifida or such rare lesions as hydatid cysts. Some details were consulted in Cruveilhier's other magnum opus, the five-volume *Traité d'anatomie pathologique generale*, which is structured according to what he refers to as "morbid anatomical species," 17 in total, subclassified as "mechanical" (wounds, ulcers, fistulae, etc), "organic or due to changes in texture" (scrofulous and cancerous degeneration, chronic inflammation, etc), "irritations," and "vital diseases." Cruveilhier himself acknowledges that this classification in unsatisfactory and based on heterogeneous principles.

Results

A brief biography of Cruveilhier

Table 1 presents key chronological details. Cruveilhier's personality and behaviour are briefly described below. He was an exceptionally sincere man. He enjoyed great professional success as a physician and surgeon. Due to his austere habits (although he did own a luxury horse-drawn carriage), he was able to accumulate considerable wealth. He was totally loyal to his family and to his origins. He acquired property and land in his native Limoges and the surrounding area, particularly the country estate in Sussac. His clients included figures from high society, including emperor Napoleon III and his family, whom he informed in a message that he would be treated in the same way as all his other patients, and to whom he did not make a courtesy visit. He was generous with his poorer patients, whom he attended free of charge. He was a tireless worker and a prolific writer, leaving a large body of work. He must have had an excellent memory, given the many times in which his remarks on some clinical case allude to other similar or related cases he had previously attended, which he recalled with total precision.

When he retired, he returned to his lands in Limoges, and may have developed cognitive impairment in his final days.

Introduction to *Anatomie pathologique du corps humain*

In the preface to *Anatomie pathologique*, Cruveilhier[2] offers several hints and explanations regarding his objectives in the creation of such an ambitious work. Firstly, he considered an atlas to be necessary because images seen once, whether in clinical practice or in the autopsy room, are soon forgotten. In his opinion, descriptions of lesions, no matter how precise, could not transmit as much information as an image. According to Cruveilhier, preserved specimens become deformed, whereas a faithful drawing is eternal, protected from the vacillations of theory. He attacks the authors of hypotheses that were often disproved by their own figures. He notes that there are many atlases of normal anatomy (including his own) but very few addressing anatomical pathology. However, he states his intention to create not a simple museum of pathological specimens, but rather a true medical treatise. Furthermore, he intended for the book to be popular and to assist medical students from their first day of study.

He humbly adds two important considerations. Firstly, he thanks those who had assisted him and the French and foreign authors of previous atlases. Secondly, he acknowledges certain limitations of his text. Showing a very modern attitude, the most significant of these limitations is his lucid recognition that he does not understand the nature of the lesions he observes. He is well aware that, in reality, he presents specimens with a descriptive terminology but does not understand their content. He notes that "anatomical pathology of the forms and connections must be associated with their texture, the only feature that can clarify the place, causes, and nature of disease and offer a solid foundation for treatment."

The clinical descriptions exude life, as in addition to the patients' clinical history, Cruveilhier comments on the diagnosis and prognosis he established antemortem, before or after offering the solution from the autopsy study, and does not hide his surprise at unexpected findings, self-criticism for diagnostic errors, or perplexity when he is unable to fully understand the lesions he finds. In many cases, alongside the illustrated case, he comments on similar cases from his own or his colleagues' experience to strengthen some point or draw attention to variants.

Table 2. List of *livraisons* addressing diseases of the spinal cord.

Volume 1
Livraison III, sheet VI. Spinal cord apoplexy
Livraison VI, sheet III. Spina bifida. Subarachnoid meningitis of the spine and ventricles
Livraison XVI, sheet IV. Spina bifida
Volume 2
Livraison XXV (*maladie des os*), sheet IV. Atlas dislocation. Spinal cord compression
Livraison XXXII, sheets I and II. Studies on paraplegia
Livraison XXXV, sheet VI. Hydatid cyst
Livraison XXXIX, sheet IV. Spina bifida
Livraison XXXVIII, sheet V. Grey degeneration

Review of the *livraisons* or submissions addressing diseases of the spinal cord

The structure of the atlas is rather unusual and sometimes difficult to follow. Cruveilhier sequenced his submissions according to the order in which they were ready for publication. Therefore, they are not ordered by organ or by disease. Thus, some include heterogeneous content with diseases of several organs. In addition to this heterogeneity of the content, Cruveilhier's reflections often include considerable digressions; the following is one curious example. In a case of spinal cord compression by a hydatid cyst, he discusses the semiological differences between paraplegia, which always presents sensory alterations, and hemiplegia, in which these alterations may not be present. He cites the example of a patient admitted to his service with complete right hemiplegia who presented no sensory disorder but was unable to speak: "She is only able to utter the words 'été, été,' and so is known on the ward as Madame Été." Thus, Cruveilhier treated a "Madame Été" more than 20 years before Broca's[37] famous "Monsieur Tan."

Each volume includes a table of contents that does not follow the numerical order of the *livraisons* but rather lists all those submissions dedicated to a particular organ. However, they are not labelled with the page

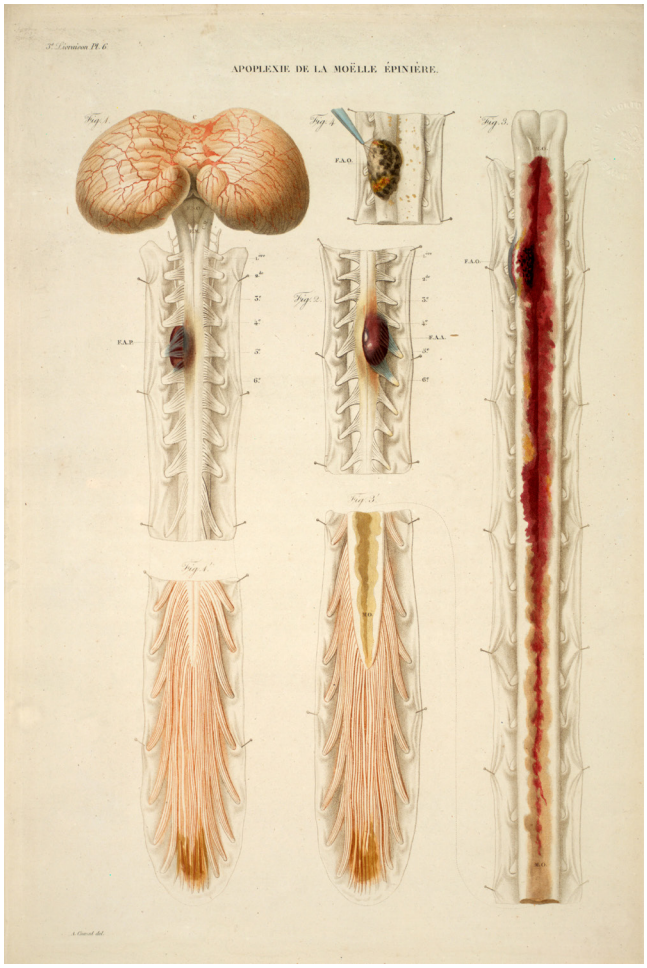


Figure 4. Haematomyelia. Probable arteriovenous malformation type II (taken from Cruveilhier[2]).

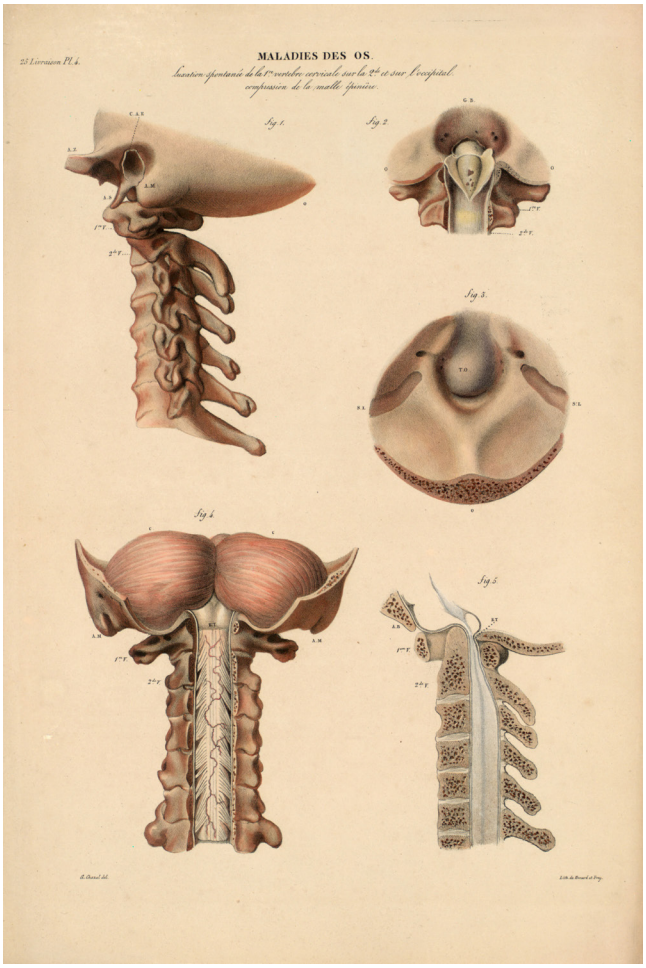


Figure 5. Spinal cord compression due to dislocation of the atlas (taken from Cruveilhier[2]).

number within the volume, which would assist in locating them, as each volume does not have overall page numbering (each submission has its own), hindering searches within the text. In the edition consulted,[2] the submissions addressing diseases of the spinal cord are those listed in Table 2.

1. *Livraison* III: haematomyelia

In this submission, headed with the full name of the patient (social sensitivity and confidentiality laws did not exist at the time), Cruveilhier describes the history of a surgery student, starting with this wonderful, concise depiction of the person: "fragile constitution, nervous temperament, mild manners, and highly sober habits." Four or five years earlier, he had presented an episode of pain in the left limbs, which spontaneously resolved after three months. The disease in question began in December 1828 with acute neck pain and blocked movement of the head, affecting the right side, followed several days later by motor deficits in the arms and legs, progressing to tetraplegia, with paralysis of the bowel and bladder. He was treated with the remedies of the time, including leeches on the neck, and died within 40 days due to ileus and a very large sacral ulcer. Autopsy examination of the

spinal cord (Figure 4) revealed a violet-coloured tumour the size of a large almond in the cervical region, and intraspinal haemorrhage (haematomyelia) occupying the entire central area of the spinal cord (Figure 4, right).

This description would be compatible with spinal arteriovenous malformation type II, according to current classifications.[38-40] In his discussion of the clinical case, Cruveilhier explains the difference between cerebral apoplexy, which causes hemiplegia but not tetraplegia and never presents with pain, except in later stages; and spinal apoplexy, which usually presents with pain at onset, preventing differentiation with spinal compression, which also causes pain. Other clinicopathological correlations are limited by the understanding at the time of the anatomy and physiology of the spinal cord, which was still rudimentary. Some authors considered the spine almost to be an autonomous organ, whereas Cruveilhier believed that this was a grave error and that impressions were sent from the spine to the brain and vice versa, in accordance with the "great anatomical law of the continuity of the nervous system." He believed that all the motor and sensory function of the spinal cord relied on its grey matter, whose destruction by haemorrhage explained the tetraplegia and the loss of sensitivity, as the white matter was merely compressed; however, he subsequently adds that the latter mechanism may also explain the symptoms: "who knows whether this defect in sensitivity and movement might not in fact be caused by pure and simple compression of the white matter." It was not known at the time that spinothalamic fibres cross over in the spinal cord, as described years later by other authors, particularly Brown-Séquard.[12(p266-274,325-327)] Thus, Cruveilhier indicates, not entirely correctly, that spinal cord lesions do not present the "crossed effect" observed in brain lesions, explaining the fact that the patient's initial symptoms affected the left hemibody, ipsilateral to the lesion. To support this idea, he mentions his own experience with a dog that had undergone extirpation of the cerebral hemispheres, in which stimulation of one side of the spinal cord caused contractions in the homolateral limbs.

2. *Livraison* XXV: atlantoaxial dislocation and spinal compression

This patient's symptoms began with mild paresis of all four limbs, progressing to right-sided hemiplegia and sensory alterations. As the patient progressed, he once more showed mild involvement of the left limbs. He reported pain at the craniocervical junction. He also had painful cramps in all four limbs, and a sensation of "freezing from the spine to the bones," which was not relieved with heating. With his characteristically frank language, Cruveilhier describes how in the autopsy, misled by the significance of the right hemiplegia, he first extracted the cerebral hemispheres, where he expected to find the lesion, but to his surprise detected no pathology upon examining them. Then he noticed necrosis of the spinal cord at the point where the atlas was dislocated (Figure 5). In his commentary, he notes that hemiplegia is an infrequent consequence of spinal cord compression as such asymmetric compression is rare. However, he also recognises that he was mistaken in his interpretation of the semiology and his diagnostic suspicion, as he should have suspected that the lesion was spinal, rather than hemispheric/cerebral, due to the fact that, while the right hemiplegia was pronounced, the other side was becoming paralysed and the cramps affected all four limbs, a typical feature of spinal cord lesions. As was his custom, in his discussion of this case he took the opportunity to describe other cases of cervical spinal compression, for instance a patient with tetraplegia secondary to purulent, caseous discitis at C2-C3, who died due to respiratory insufficiency, which Cruveilhier correctly attributes to the loss of innervation of the respiratory muscles.

3. *Livraison* XXXII: studies on paraplegia

This instalment, which was particularly highlighted and recommended by Charcot,[11] features an introduction in which Cruveilhier explains his interest in diseases of the spinal cord. Firstly, he believed that, contrary to diseases of the brain, there had been little interest in diseases of the spinal cord, with the exception of Olivier d'Angers. He considered that the difficulty of extracting the spinal cord in autopsy studies was insufficient justification for this, as instrumentation was available to perform this task. In any case, he trusted that his position at the Salpêtrière, where he received all his patients with paraplegia and tetraplegia, would enable him to further the understanding of diseases of the spinal cord.

In this submission, like in the others, Cruveilhier follows the French tradition in the classification of paraplegias (Table 3).

Thus, as an example of spinal compression, sheet I illustrates a case of acute paraplegia due to a

Table 3. Cruveilhier's classification of paraplegia.

1. Due to tissue alterations
2. Due to compression
3. Acute paraplegia due to inflammation of the spinal arachnoid mater
4. False paraplegia or paralysis due to immobility and rigidity (sometimes accompanied by incontinence)
5. Though not included in the classification, he describes a case of functional or probable psychogenic paraplegia, reversible by suggestion.

haemorrhagic tumour of the cauda equina, extending up the spinal cord to the thoracic region, which may be an ependymoma that had bled.

As an example of paraplegia due to inflammation of the spinal arachnoid or "spinal meningitis," he describes the story of a young patient who was studying to be a midwife. The patient presented numbness, pain, and weakness in one foot, spreading in a matter of days to the rest of the leg; based on these findings, Cruveilhier predicted that it would progress to paraplegia. And he was right: the patient eventually became tetraplegic with paralysis of the bowel and bladder, as well as difficulty breathing that left her "between life and death." Today, this case would be classified as reversible inflammatory acute transverse myelopathy, as the patient recovered and Cruveilhier came across her years later, practising midwifery.

To illustrate the "induration of the spinal cord," he describes three patients with different types of progressive paraplegia or tetraplegia whose autopsy studies revealed "hardening" of the spinal cord, as though it had been fixed in alcohol. In one of the cases, the spinal cord presented clear flattening and atrophy; dissection revealed disappearance of the white matter. In another case, in addition to induration of the spinal cord, he found other focal hardening in the trunk and scars from older foci in the white matter. He reflects on the cause of these lesions, which he finds disconcerting and which are difficult to attribute retrospectively to a chronic degenerative or inflammatory process such as primary progressive multiple sclerosis or Devic disease.

As an example of "false paraplegias," (by which term he actually refers to a truly paraplegic patient whose lesion does not involve the spinal cord) associated with immobility and rigidity, he presents a case of flexion paraplegia with restriction of the joints, caused by large ischaemic brain lesions. Many years later, Alajouanine[41] conducted an extensive study of this type of paraplegia, without citing Cruveilhier.

Also highly interesting are the cases that may be classified within the first group, secondary to "alteration of the spinal cord tissue itself," several examples of which are shown in sheet II (Figure 6).

The case labelled Fig. 3 depicts the spine cord of a patient with tetraparesis whose most striking symptom was disordered voluntary movement, which he characterises as chronic "St Vitus' dance."

The clinical history had started 17 years earlier, at the age of 37, when she presented sensory disorders in the feet, fulgurant pain, and unsteady gait that caused falls and forced her to lean on walls. Over time, she began to present involvement of the hands and very intense sensory alterations, to the extent that she was no longer able to recognise objects, which fell from her hands. The arthritis and sores were painless.

Such severe sensory disorders suggested that the abnormal movement was caused by sensory ataxia, rather than chorea. This hypothesis is supported by the autopsy study, which revealed degeneration of the posterior columns of the spinal cord, after both external observation and dissection; the dorsal nerve roots were filiform and transparent, whereas the lateral columns were normal. Cruveilhier believed that this case demonstrated the independence of diseases of different columns of the spinal cord. However, while he was convinced that the posterior columns were essential in sensory function, he still had questions regarding their potential role in motor function, which may explain the patient's abnormal movements, as he was unable at the time to suspect deafferentation as the cause. In summary, the patient presented a syndrome of the dorsal spinal roots or a sensory neuronopathy whose possible hereditary[42] or acquired[43] aetiology is not addressed in any detail.

4. "Grey degeneration" of the spinal cord

Cruveilhier gave the name "grey degeneration" to the lesions shown in Figures 6 (*livraison* XXXII) and 7 (*livraison* XXXVIII), which are unmistakably

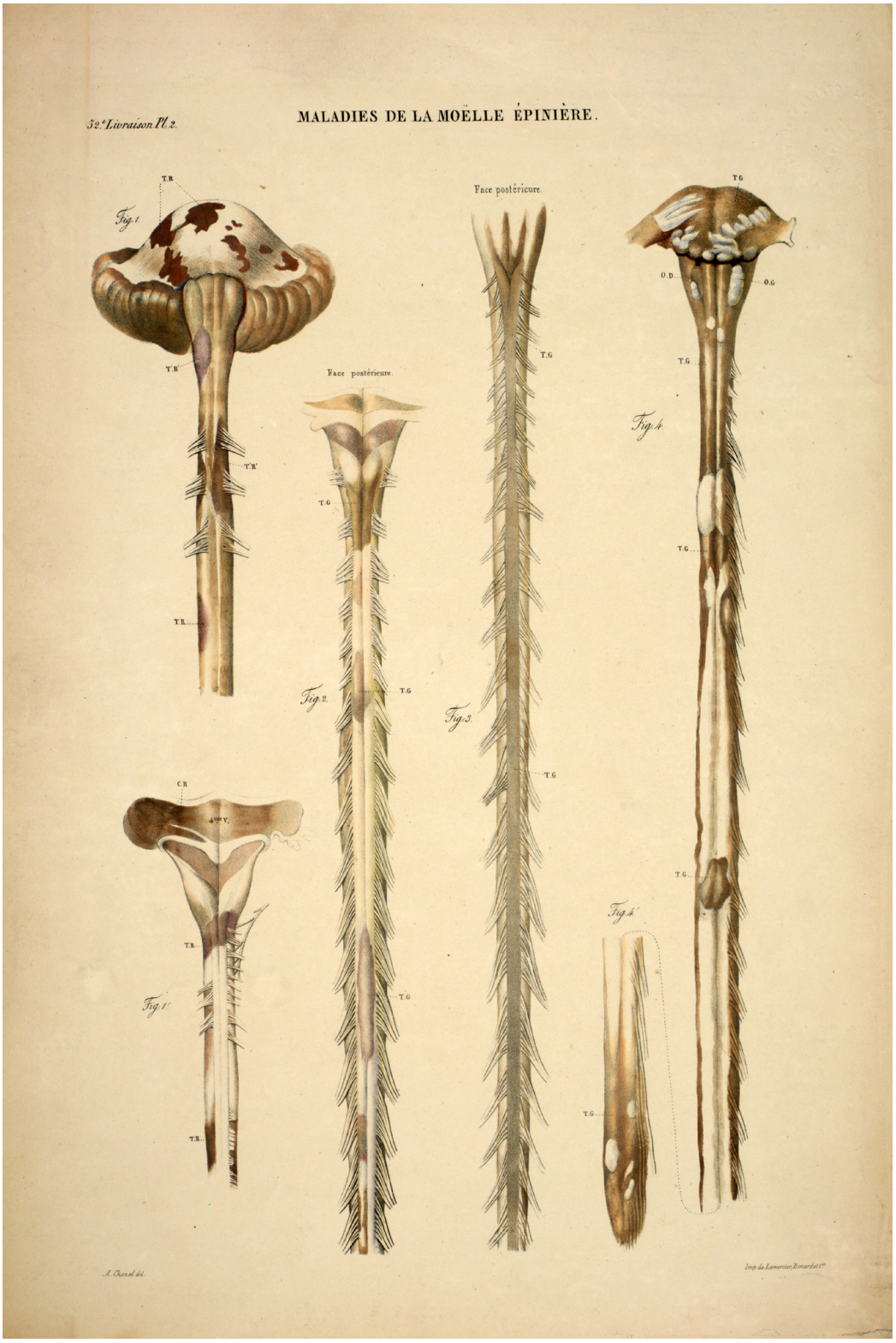


Figure 6. Montage of four cases. The lesions in figures 1, 1', and 2 (on the left) are described as "grey degeneration," obtained from two autopsy studies of paraplegic patients with no clinical history given. Figure 3 is from a patient with degeneration of the dorsal spinal roots (which are thinner than in fig. 2) and the posterior columns (coulored darker). Figure 4 is from another patient with "grey degeneration" lesions; precise clinical descriptions are included for both (taken from Cruveilhier[2]).

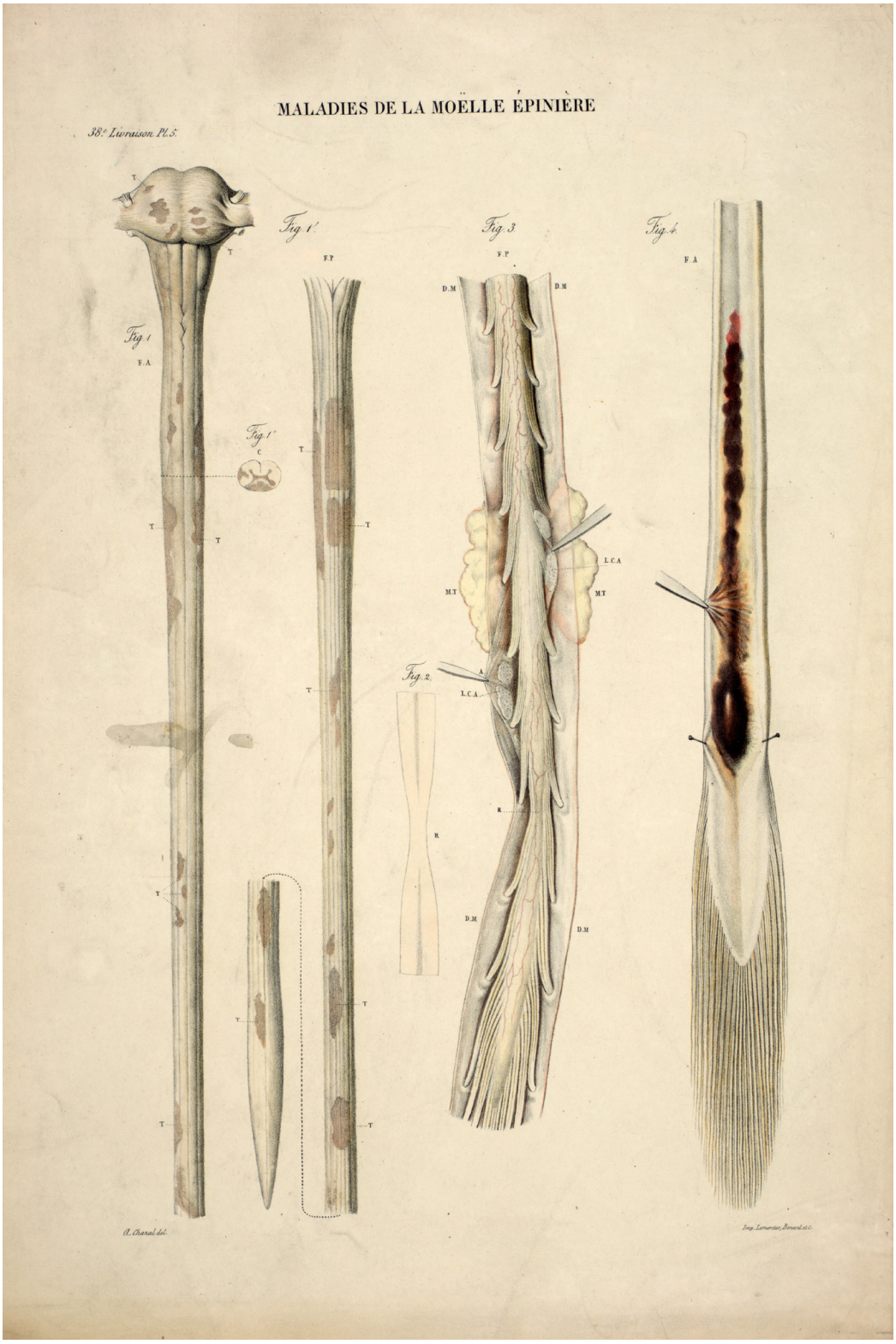


Figure 7. Montage of three cases. The two images on the left are from a patient with "grey degeneration" lesions, for whom a thorough clinical history is offered. The other two images, on the right, are from a patient with spinal cord compression due to Pott disease and from another patient with haematomyelia, respectively (taken from Cruveilhier[2]).

characteristic of multiple sclerosis, as was acknowledged by Charcot.[11] The author presents no clinical data for the cases labelled Fig. 1, 1', and 2 in Figure 6. However, regarding the case of Fig. 3, he comments that the patient was a 37-year-old woman, a cook, who six years earlier had presented weakness in one leg, and later in the arms, which "were weak and tremorous." She presented withdrawal reflex of the legs to touch, spasmodic dysarthria and sobbing, and loss of visual acuity. He found the typical translucent grey lesions in the pons, peduncles, corpus callosum, optic tracts, radiations of the corpus striatum, etc.

He wondered what this grey transformation may be, and stated that at a later time he would attempt to establish the correlation between these lesions and clinical symptoms. Looking retrospectively at this case, a century and a half later, any modern neurologist would be confident in suspecting a case of multiple sclerosis in a young woman with spastic paraparesis, pseudobulbar palsy, poor visual acuity, and tremor in the arms.

Another example of multiple sclerosis lesions is shown in Figure 7 (*livraison* XXXVIII); in this case, Cruveilhier provides a detailed clinical history spanning more than two pages. To summarise, the patient was a young woman of 38 years of age who was admitted to Hôpital de la Charité due to bronchitis. Cruveilhier took an interest in the case after observing her "weak and uncertain" arm movements (dysmetria, tremor?). He asked her to stand and observed that she had poor balance, that she trembled over her legs, and that her left leg was very weak. The patient's symptoms had started 18 months earlier, with tingling on the soles of the feet, ascending to the legs, and tremor in the hands, with the patient frequently dropping objects, leading her to stop working a year earlier. In the last months she dragged her legs and struggled to walk. In bed, she was able to move her legs but not to hold them up. The sensitivity disorder was very intense in the legs, in all aspects (touch, light touch, pinprick, pinching). The most striking sensory disorder in the arms was the inability to hold a small object (eg, a needle): when she closed her eyes, she dropped the object but continued making manipulative movements, as though it were still in her hand. She was unable to make fine movements, even with visual control. The left arm was weaker, but the right arm also presented poor pressure.

In the light of these findings, Cruveilhier suspected a disease "of the spinal cord tissue itself," ruling out compression, which "is always accompanied by pain, cramps, shaking, and stiffness," and, "unless it is complete, also presents with phenomena of irritation." The patient complained of a sensation of "circular constriction of the abdomen," which Cruveilhier correctly highlights as a characteristic of spinal lesions. She also had neuropathic pain in one leg (as though "a dog were chewing it from the inside"). The patient died of a pulmonary infection with pleurisy. The autopsy study of the spine revealed the characteristic lesions of "grey degeneration," "more abundant in the posterior and lateral columns," which "were not merely superficial, but extended to the interior" and in which "the white matter had completely disappeared." He noted that the lesions were indurated (the only thing his description lacks is the term "sclerosis"). He then poses numerous questions on the possible origin of these lesions, which he was unable to associate with any process he recognised, such as apoplexy, scarring, inflammation, etc.

In summary, he presents a case of multiple sclerosis, perfectly recognisable from both the clinical and the pathological descriptions, many years before Charcot (who, as mentioned earlier, did not hesitate to acknowledge Cruveilhier as the first author to describe the disease).

Comments

It is clear that Cruveilhier's *Anatomie pathologique* achieved the objectives he established when he set out to create his magnum opus, at least with regard to diseases of the nervous system and particularly of the spinal cord (the subject of the present article). The insight from his cases, both clinical and pathological, are timeless. It is precisely his approach, with both clinical and pathological descriptions, that makes Cruveilhier's work so valuable and original for its time.

Regarding diseases of the spinal cord, it is worth highlighting his efforts to diagnose in life the main categories of diseases, whether they affect "the spinal cord tissue itself" or are caused by inflammation or compression. Although some of his ideas, such as his doubts regarding the function of the posterior columns, have been disproven, many others remain perfectly valid today; for example, the idea that compression, and particularly partial compression, is more frequently

accompanied by local pain and spasms than intrinsic spinal cord lesions. The specificity of band- or corset-like pain as a characteristic of spinal cord lesions due to pressure on the posterior columns constitutes another example.

Due to the still limited means available at the time, Cruveilhier was unable to go beyond descriptive pathology and analyse the nature of lesions and their treatment, as he asserts he would have wished to do. However, with respect to that which was within his reach, clinicopathological description, there can be no doubt that he reached the highest level and was ahead of his time, offering the first descriptions of various entities and syndromes including spinal muscular atrophy, Chiari malformation, and particularly, as summarised in this article, degeneration of the dorsal spinal roots and multiple sclerosis.

The figure of Cruveilhier should recover a position of honour among the clinicians and pathologists who developed neurology at a time when it still lacked a name, several decades before Charcot arrived at the Salpêtrière. Not everything began with Charcot.

Conflicts of interest

The author has no conflicts of interest to declare. This study has received no public or private funding.

References

1. Flamm ES. The neurology of Jean Cruveilhier. Med Hist. 1973;17:343-55.
2. Cruveilhier J. Anatomie pathologique du corps humain [Internet]. Paris: Bailliere; 1829-1842 [accessed: 10 Nov 2020]. Available from: https://archive.org/details/traitdanatomiepa04cruv/page/n7/mode/2up?ref=ol&view=theater
3. Vayre P. Jean Cruveilhier (1791-1874): chirurgien promoteur de la preuve par les faits à la médecine fondée sur la preuve. E-mémoires Acad Nat Chir. 2008;7:1-12.
4. Clarac F, Boller F. Chapter 40: history of neurology in France. Hand Clin Neurol. 2010;95:629-56.
5. Clarac F, Barbara JG, Brousolle E, Poirier J. Figures and institutions of the neurological sciences in Paris from 1800 to 1950. Introduction and Part I: neuroanatomy. Rev Neurol (Paris). 2012;168:2-14.
6. Brousolle E, Poirier J, Clarac F, Barbara JG. Figures and institutions of the neurological sciences in Paris from 1800 to 1950. Part III: neurology. Rev Neurol (Paris). 2012;168;301-20.
7. Bonduelle M. La Salpêtriére, de Mazarin à Charcot. Hist Sci Med. 1997;31:163-70.
8. Seilhean D. Neuropathology in Pitié-Salpêtriére hospital: past, present and prospect. Neuropathology. 2020;40:3-13.
9. Poirier J. Jean-Baptiste Vincent Laborde (1830-1903) neurologue and neurophysiologue oublié. Geriatr Psychol Neuropsychiatr Vieil. 2015;13:73-82.
10. Bogousslavsky J, Walusinski O, Moulin T. Alfred Vulpian and Jean-Martin Charcot in each other's shadow? From Castor and Pollux at La Salpêtrière to neurology forever. Eur Neurol. 2011;65:215-22.
11. Charcot JM. Leçons sur les maladies du système nerveux. Paris: Bureaux du Progrès Médical; 1892. Tome premier, sixième leçon; p. 190.
12. Spillane JD. The doctrine of the nerves. Oxford: Oxford University Press; 1981.
13. Walusinski O, Poirier J. L'essor de la neuropathologie au service de la clinique, à la Salpêtrière (1862-1923) [Internet]. [s.l.]: Olivier Walusinski; Ago 2011 [accessed: 30 Oct 2020]. Available from: http://baillement.com/recherche/chapitre_ow_jp.pdf
14. Cruveilhier J. Des devoirs et la moralité du médecin [Internet]. Paris: Baillière; 1837 [accessed: 1 Dec 2020]. Available from: https://archive.org/details/McGillLibrary-osl_devoirs-moralite-medecin_pamphlet-17999/page/n3/mode/2up
15. Berhouma M, Dubourg J, Messerer M. Cruveilhier's legacy to skull base surgery: premise of an evidence-based neuropathology in the 19th century. Clin Neurol Neurosurg. 2013;115:702-7.
16. Davis M, Loukas M, Tubbs RS. Jean Cruveilhier and his contributions to understanding childhood hydrocephalus, Chiari II malformation, and spina bifida. Childs Nerv Syst. 2018;34:1613-5.
17. Pearce JMS. Arnold-Chiari, or "Cruveilhier-Cleland-Chiari" malformation. J Neurol Neurosurg Psychiatry. 2000;68:13.
18. Compston A. The 150th anniversary of the first depiction of the lesions of multiple sclerosis. J Neurol Neurosurg Psychiatry. 1988;51:1249-52.
19. Pearce JMS. Some British contributions to the history of multiple sclerosis. J Neurol Neurosurg Psychiatry. 1989;52:303.
20. Pearce JMS. Historical descriptions of multiple sclerosis: the stories of Augustus D'Este and The Journal of a Disappointed Man. Eur Neurol. 2005;54:49-53.
21. Ruiz Ezquerro JJ, Ruiz López M. De la atrofia y la degeneración gris a la enfermedad desmielinizante inmunomediada y el daño axonal. In: Ruiz Ezquerro JJ, ed. EM Historia. La esclerosis múltiple a través de los tiempos. Meres (ES): La fábrica de los Libros; 2016. p. 173-201.
22. Aran FA. Recherches sur une maladie non encore décrite du système musculaire (atrophie musculaire progressive). Arch Gén Méd. 1850;24:5-35,172-214.
23. Cruveilhier J. La paralysie musculaire progressive, atrophique. Bull Acad Méd. 1853;18:490-501,546-83.
24. Cruveilhier J. Sur la paralysie musculaire progressive atrophique. Arch Gén Méd (Paris). 1853;1:561-603.

25. Roberts W. An essay on wasting palsy (Cruveilhier's atrophy). Br Foreign Med Chir Rev. 1858;22:458-61.
26. Banks JT. On muscular atrophy (maladie de Cruveilhier). Br Med J. 1871;1:29-30.
27. Drouin E, Drouin AS, Péréon Y. Cruveilhier versus Charcot. Lancet Neurol. 2016;15:362.
28. TheFreeDictionary [Internet]. Huntingdon Valley (US): Farlex, Inc.; ©2003-2021. Median atlantoaxial joint; ©2012 [accessed: 1 Dec 2020]. Available from: https://medical-dictionary.thefreedictionary.com/Cruveilhier+joint
29. Bakay L. Cruveilhier on meningiomas (1819-1842). Surg Neurol. 1989;32:159-64.
30. Pearce JMS. Cruveilhier and acoustic neuroma. J Neurol Neurosurg Psychiatry. 2003;74:1015.
31. EcuRed [Internet]. Cuba: EcuRed; [s.d.]. Jean Cruveilhier; 23 Aug 2019 [accessed: 2 Dec 2020]. Available from: https://www.ecured.cu/Jean_Cruveilhier
32. Wikipedia, The Free Encyclopedia [Internet]. [s.l.]: Wikimedia Foundation, Inc.; 2021 [accessed: 2 Dec 2020]. Available from: https://en.wikipedia.org/wiki/Jean_Cruveilhier
33. Geneanet [Internet]. [s.l.]: Geneanet; 2021. Jean Cruveilhier; [s.d.] [accessed: 2 Dec 2020]. Available from: https://gw.geneanet.org/muf?n=cruveilhier&oc=&p=jean.
34. Whonamedit? [Internet]. Norway: Ole Daniel Enersen; [s.d]. Jean Cruveilhier; [s.d.] [accessed: 2 Dec 2020]. Available from: http://www.whonamedit.com/doctor.cfm/892.html
35. Chabatz D'Entrar [Internet]. [s.l.]: [s.n.]; [s.d.]. Jean Cruveilhier; 17 Mar 2008 [accessed: 2 Dec 2020]. Available from: https://chabatzdentrar.blog4ever.com/jean-cruveilhier
36. Historia de la Medicina [Internet]. Valencia (ES): José L. Fresquet; ©2020. Jean Cruveilhier (1791-1874); Aug 2008 [accessed: 2 Dec 2020]. Available from: https://www.historiadelamedicina.org/cruveilhier.html
37. Broca P. Perte de la parole, ramollissment chronique et destruction partielle du lobe antérieur gauche du cerveau. Bull Soc Anthropol Paris. 1861;2:235-8.
38. Spetzler RF, Detwiler PW, Riina HA, Porter RW. Modified classification of spinal cord vascular lesions. J Neurosurg. 2002;96:145 56.
39. Kim LJ, Spetzler RF. Classification and surgical management of spinal arteriovenous lesions: arteriovenous fistulae and arteriovenous malformations. Neurosurgery. 2006;59:S195 201.
40. Saliou G, Krings T. Vascular diseases of the spine. Handb Clin Neurol. 2016;136:707-16.
41. Alajouanine T. Sur un type de paraplegie en flexion d'origine cérébrale avec exagération de l'automatisme médullaire. Arch Neur Psych. 1924;11:110-1.
42. Biemond A. La forme radiculo-cordonale postérieure des dégénérescences spino-cérébelleuses. Rev Neurol (Paris). 1954;91:3-21.
43. Dalakas MC. Chronic idiopathic ataxic neuropathy. Ann Neurol. 1986;19:545-54.