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History of Neurology

Fungous tumour in the dura mater, first description of meningioma by the surgeon Antoine Louis (1723–1792)

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INFO ARTICLE

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Is it currently conceivable to diagnose meningioma from the visual appearance of a tumour that deforms the scalp by ulcerating the skull as it exteriorises itself? This is, however, what the Surgery School in Paris, led by Antoine Louis (1723–1792) did and the way in which they described this type of brain tumour in 1774, using the term “fungous tumour of the dura mater” (*fungus duræ matris*). The Latin “*fungosus*” denotes that which has the form of a fungus. At that time, the qualification of fungous was added to the description of some cancers, various ulcers, syphilitic chancres, and cold abscesses (tuberculous) spontaneously opened; that is, it describes the edges of any swollen, bleeding wound [1].

1. A famous surgeon in the 18th century

The son of a military surgeon, Antoine Louis was born on 13 February 1723 (Fig. 1). After his education in a Jesuit school, he followed in his father’s footsteps, becoming at age 20 an *aide-major* surgeon in the army, before undergoing training in Paris under the surgeon François Gigot de La Peyronie (1678–1747),

surgeon to King Louis XV and founder of the French Academy of Surgery. Louis passed his exams, becoming a La Salpêtrière surgeon. It should be noted that he was the first surgeon to defend a doctoral thesis, on 25 September 1749, before a jury presided by Sauveur-François Morand (1697–1773). His thesis focused on head wounds, and he wrote in Latin, a privilege hitherto reserved for physicians, whereas the writings of surgeons at that time were usually in French [2]. In response, a journalist wrote, “All is lost, Latin is spoken by Saint-Côme”, referring to the brotherhood of Saint-Côme and Saint-Damien, the first professional association in France for surgeons.

Admitted in 1756 to the French Academy of Surgery, of which he would become the secretary elected for life, Louis received every honour throughout his long career. Briefly a surgeon at La Charité Hospital, he was dismissed after a conflict with the Brothers at this institution. He then became surgeon of the Rhin Army from 1761 to 1763, followed by a time as inspector general of the kingdom’s hospitals. Finally, he ended his career as a professor of physiology.

Louis was in charge of the surgery entries in the *L’Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers* (*Encyclopaedia, or a Systematic dictionary of the sciences, arts, and crafts*), edited by Denis Diderot (1713–1784) and Jean Le Rond d’Alembert (1717–1783). Louis wrote extensively on various surgical methods such as those for lacrimal fistulae, gunshot wounds, lithotomy, shaping stumps following amputation, treating harelip, etc. [3].

After completing his Doctor of Law and becoming a lawyer at the Parliament of Paris, he was recognised as a founder of legal medicine. For example, his expertise was crucial in the rehabilitation of Jean Calas, executed for a crime he did not

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Fig. 1 – Antoine Louis in 1778 (© Wellcome Collection, public domain).

commit. He was consulted on a system of decapitation based on the recommendations of Joseph-Ignace Guillotin (1738–1814) and aimed at an egalitarian method for applying the death penalty. He invented the angled blade after testing it on cadavers and animals. Louis died before learning of the ravages of his invention during the Revolution, which led to its common nicknames, “Louison” and “Louisette”, but the initial idea came from Guillotin.

Louis died of pneumonia on 20 May 1792. Interred as per his request among the poor in the cemetery of the Hospice de La Salpêtrière, his grave disappeared along with this site when the institution was enlarged in the 19th century [4].

2. Antoine Louis’s dissertation on fungous tumours of the dura mater

In 1774, Louis published his *Mémoire sur les tumeurs fongueuses de la dure-mère* (Dissertation on the fungous tumours of the dura mater) in the *Mémoires de l’Académie royale de Chirurgie* (dissertations of the Royal Academy of Surgery) [5]. These tumours “appear suddenly under the integuments of the head and can only do so after silently eroding the bones that should have resisted their progress toward the exterior” (Fig. 2). To



Fig. 2 – Illustration of the thesis of J.P. Kaufmann in 1743 [6] (© BIUSanté, Université Paris Cité).

explain the tumour’s erosion of the skull, Louis drew a parallel with the process by which an aneurysm of the aorta is exteriorised by erosion of the sternum.

Louis compiled nineteen observations by several authors, which he added to his own, summarised below. A 35-year-old man fell to a sitting position in a stairway in December 1761. Following that, “he felt dazed” for several months. Some time later, his barber noticed “a sort of crackling, similar to the crumpling of dry parchment, seemingly stretched beneath the integuments”. The following day, the patient noticed a tumefaction “with a pulsating movement”. Louis added, “Clearly the crackling felt the previous day was the effect of the compression of the razor and the barber’s fingertips on the surface of the parietal bone, thinned by the fungus, which only covered its summit by a very superficial lamina whose lack of thickness had made it supple”. The mass grew rapidly. By wearing a compressive bandage, the patient saw the mass go away, but was frightened by the attendant dizzy spells. The mass had the size of a turkey egg and became painful. Compressing it relieved the pain but rapidly resulted in loss of consciousness. The patient died in April 1763. During the autopsy, Louis observed that the tumour “was part of the convex surface of the dura mater; its volume was that of a fist, it was regularly circumscribed, and it was a little less salient under the skull than on the outside... The protuberant part under the skull, creating a bump on the dura mater, was located in a depression it had formed in the corresponding brain area. The internal surface of the dura mater at the

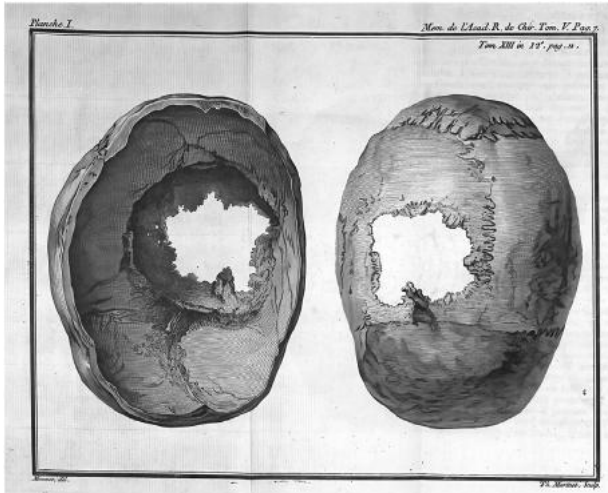


Fig. 3 – La perforation contre-nature (perforation contrary to nature), an observation of one of Louis's cases (© BIUSanté, Université Paris Cité).

location of the tumour was thicker than elsewhere, and its larger vessels seemed to have a varicose arrangement". He noted the lack of adherence to the skull, then described in detail "the perforation, which was contrary to nature" (Fig. 3). The possibility of osteosarcoma, Ewing sarcoma, giant cell tumour, or metastatic carcinoma may be considered, but the relatively slow progression over two years and the compressive effect on the adjacent dura mater and brain seem consistent with a slow-growing benign process, such as extradural meningioma.

Louis included an observation reported by Ambroise Paré (1510–1590) of possible aneurysm that had eroded the skull, but that Louis considered a fungous tumour [7]. He did not fail to agree with Paré's observation: "In the wounds of the head accompanied by significant loss of the bone cap, there is no protuberance of the brain as long as the dura mater contains this viscus" (Observation X).

He noted that his colleague Jean-Louis Petit (1674–1750) had observed several cases of "tumours with pulsation on the surface of the skull and in the cavity formed in the bone", but he, too, had made an error with his diagnosis of aneurysm [8]. We can cite some of the cases Louis compiled to confirm his demonstration. In 1730, in the journal of the *Deutsche Akademie der Naturforscher Leopoldina*, the German Johann Salzmann (1672–1738) published the first description with illustrations of an intra- and extracranial hourglass-shaped tumour: "Exostosis seu excrescentia cranii osseo-spongiosa" (Louis's Observation XIII) [9]. The man was 43 years old and had exhibited a left frontal-parietal rounded tumefaction for at least four years. He suffered from continuous headaches and died suddenly during an epileptic seizure. The autopsy revealed an "osseous cavity" containing a tumour with a soft consistency that had pushed against the brain and meningeal vessels. "The dura mater was callous"—a sign that the meninges had been driven back by compression [10]. Observation XVI, reported by

Louis and based on that of a colleague known as Grima, is like that of Salzmann (Fig. 4).

Louis drew on German theses in a work of the Swiss Albrecht von Haller (1708–1777) who republished them in 1755 [11]. We can cite the thesis of Gørgius Stoltz, *De Fungo Cerebri*, defended on 7 December 1700 before a jury presided by Gottfried Sand (1647–1710) [12]. There is also that of Johann Philipp Kaufmann, *De tumore capitis fungoso post cariem cranii exorto*, defended in Helmstad in 1743 before a jury presided by Johann Friedrich Crell (1707–1747) (Fig. 2). Kaufmann described the operation performed by Lorenz Heister (1683–1758), which is often considered as the first operation on a meningioma [6]. The man who underwent the operation was a 34-year-old Prussian soldier who died 48 hours later due to complications from infection. For Louis, the diagnosis of the type of humour was not made by Heister who was trying to extirpate a "pillar" cyst, whereas it was in fact "a fungous tumour of the dura mater".

3. Aetiopathogenesis developed by Louis

Louis underscored the divergent views of physicians, surgeons, barbers, and healers consulted by patients who all suffered from intense, localised headaches over a long period before the tumefaction appeared and deformed their scalp. Finding tumoural pulsatility led a number of these practitioners to diagnose aneurysm, which meant therapeutic abstention, a benediction for the patients. By contrast, others, noting the soft consistency of the deformation, proposed or performed from the start an incision to remove any accumulation of fluid. Louis did not fail to demonstrate that this option, which he likened to ablation or cauterisation with a hot iron of the exteriorised part of the tumour, made rapid death inevitable for the patients. For Louis, there could be no confusion because the integuments were healthy and it was possible to feel and envelop the contours of the osseous orifice with the fingers: "If the cavity is not the main vice, the bone is healthy". In other word, he distinguished between bone infections, tuberculous at that time and causing shards and underlying bone softening, from perforation caused by mechanical wear through compression, leaving the edges thinned but healthy. The observations Louis put forward of patients treated by compression, application of caustic substances, etc., and who died rapidly, confirmed for him that the diagnosis of a meningeal origin for the tumour was not considered, even though in each case, the autopsy revealed an hourglass-shaped tumour like that in his personal case (Fig. 4).

Since in each of the examples cited, an impact preceded the appearance of the tumour, which the dura mater connected to the bone by multiple filaments, each containing a vessel, Louis deduced a pathophysiology causing the tumour: "the very likely possibility of the formation of internal congestion further to a slight percussion that was incapable of being the primitive cause of severe accidents". A haematoma located in the spongy part of the skull, would explain the continuous headaches and could be a new indication "for trepanning". He completed his conception of the pathophysiology of the lesion as follows: "The sarcomatous vegetation,

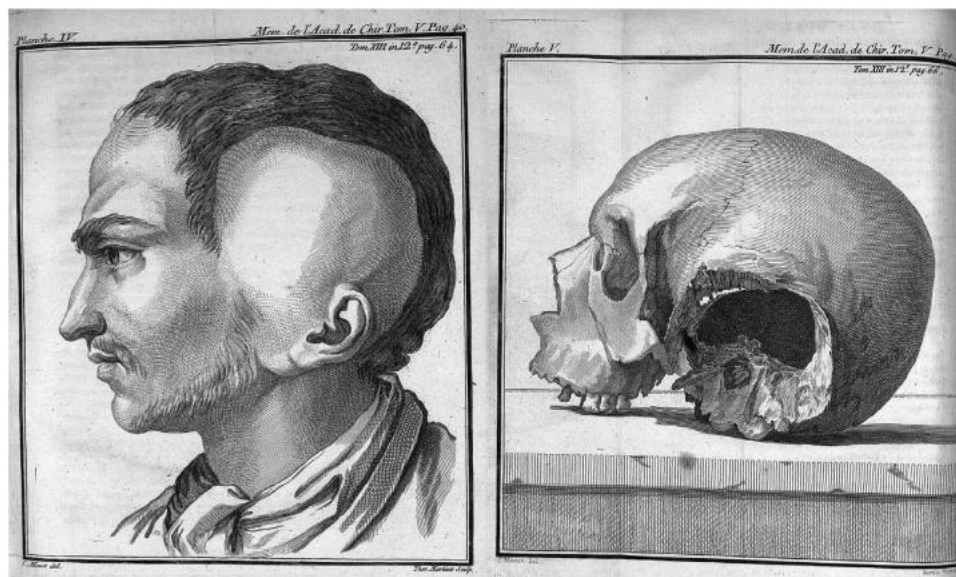


Fig. 4 – Illustrations of Louis's observation XVI (case sent by "Grima") (© BIUSanté, Université Paris Cité).

whose formation precedes the destruction of the bone, secondarily damaged due entirely to the compression of the fungous tumour on its substance". For him, the term "sarcoma" meant "tumour" but, without a microscope, he could not know whether it was benign or malignant, only knowing that "the fungous substance of the dura mater was covered by a membrane that exactly circumscribed its extent".

4. Louis's conception of surgery

Louis drew on the operation Goergius Stoltz reported in his thesis, *De Fungo Cerebri* [13]. In 1695, a 31-year-old soldier was operated on for a cranial tumefaction brought to light by intolerable continuous headaches. The surgeon gradually enlarged, in several stages, the osseous orifice without touching the tumour, "through multiple applications of crowns". According to Stoltz, Gottfried Sand noted the extreme sensitivity of the meninges; touching them resulted in violent pain. Following an initially favourable course, the patient died of haemorrhaging and infection before the tumoural mass was removed. Louis reworked this operating principle. He proposed not acting on the prolapsed mass but rather starting by enlarging the orifice "using gouges and hammers" to extirpate the mass as a single piece while ensuring haemostasis: "It is only after having removed the osseous circumference that covers the base that methods should be used to destroy the sarcomatous vegetation in the dura mater, namely extirpation, ligature, aromatic powders, or even suitable cathartics depending on the situation". He went on to indicate how one should proceed, using the conditional tense, suggesting he had never performed what he had conceived of, all while recommending it to others: "What appeared to be a cyst at the base of the tumour should have been circularly incised; then it would have been possible to extirpate it without cutting into the internal lamina of the dura mater". He did not fail to offer this assurance: "The significant

loss that must be applied to the skull to reveal the fungous vegetation of the dura mater has no disadvantages".

5. Rarity of the pathology described by Louis

The series of cases compiled by Louis over nearly a century are indicative of the rarity of the clinical picture he was trying to describe. He appears to have been unaware of a predecessor, Félix Platter (or Plater) (1536–1614) of Basel [14]. Platter is considered to have made the first clinical observation, in 1614, of what we refer to as meningioma [15,16]: "A round fleshy tumor, like an acorn. It was hard and full of holes, and as large as a medium-sized apple. It was covered with its own membrane and entwined with veins. However, it was free all of connections of the matters of the brain so much so that when it was removed by hand, it left behind a remarkable cavity". Martin George Netsky (1917–2005) and Jean Lapresles (1921–2000) translated the Latin into English in 1956, certifying that Platter had observed a supracallous parasagittal meningioma [17].

We should recall that the study of skulls from the prehistoric era or from Egyptian mummies proves that intracranial tumours eroding the cranial vault have always been observed and differ from trepanations by their appearance [18].

6. Louis as the inspiration for the thesis of Jean-Baptiste Desgranges (1751–1831)

To obtain the position of professor at the Royal College of Surgery in Lyon, Jean-Baptiste Desgranges [19] (Fig. 5) defended a thesis in 1779 (Fig. 6), presided by Jean-Baptiste Morel (1744–1821) and inspired by the dissertation of Louis, in whose footsteps Desgranges followed [20]. He began his thesis by a detailed, accurate presentation of the anatomy of bones of the



Fig. 5 – Jean-Baptiste Desgranges (1751–1831) (© BU Lyon 1, Bibliothèque Diderot de Lyon).

skull and the dura mater, providing the details of the latter's vascularisation. He did not fail to note the movements of the brain "resulting from the retrogressive impulsion of the blood". Rather than bringing together a multitude of observations as Louis had, Desgranges clearly presented various clinical situations and did not fail to suggest a pathophysiology mainly involving circulatory disorders. He put forward differential diagnoses, which Louis did not cover, and he suggested that a diagnosis could be made before the bone perforation. Desgranges saw only tubercles as an alternative to the "fungous tumour". He went into the details of the operation, following Louis's method, but so thoroughly he seemed to have actually performed it, by contrast to Louis: "The essential point is to open the skull wide and destroy the entire osseous circle hiding the base of the tumour" and for this purpose, "the trepanning will be carried out with help of a lift, a saw, incisive pliers, a raspator, and a lenticular knife". All of this "requires that trepanning be performed slowly and with a light touch". Desgranges advised only excising the mass freed up in this manner in exceptional cases. He preferred to direct the inevitable suppuration until the tumour's rotting led to its spontaneous fall at the end of a process of "putrid

melting". At no point does Desgranges mention the survival of the patient or even if it were possible. This thesis is an interesting addition to Louis's dissertation, which would justify considering them both, in association, as pioneers of surgery on meningiomas. The first documented operation from which a 45-year-old woman survived was performed in Italy on 29 July 1835 by Zanobi Pecchioli (1801–1866), a professor of surgical medicine in Siena [21].

7. But what did Louis really describe?

On 1 April 1846, Dominique-Auguste Valette (1821–1866) defended his thesis, *Des tumeurs fongueuses de la dure-mère et des os du crâne* (*Fungous tumours of the dura mater and bones of the skull*) [22]. He was one of the first to criticise Louis's dissertation, finding fault in the amalgamation of disparate clinical cases; that is, involving different types of tumours. The American neuropathologist Cyril Courville (1900–1968) made the same criticism in 1945, considering some of the cases reported by Louis as osteosarcomas [23]. Whatever the case may be, the anatomopathologists of the 19th century had difficulty naming these tumours, notably due to the inaccuracy regarding the origin of the constituent tissues, either one of the meninges (arachnoid or dura mater) or the skull. In 1849, Jean Cruveilhier (1791–1874), in his *Atlas d'anatomie pathologique* used the term "fibrophyte de la dure-mère", or cancerous tumour of the meninges [24]. In 1857, Hermann Lebert (1813–1878) spoke of a fibroplastic or sarcomatous tumour of the dura mater [25]. As for Charles Robin (1821–1885), in 1869 he wrote an article on the anatomopathology of the serous membranes and used the term "epithelioma of the arachnoid" to establish an accurate macroscopic and microscopic description [26]. He called to mind the contribution of Rudolf Virchow (1821–1902) who used the term "Sarkome der Dura mater", or "psammoma", and affirmed that the histological benignity of these tumours "that proceeds very ordinarily from cells and even the epithelial lining of the arachnoid" [27].

In 1864 in Paris, Charles Bouchard (1837–1915) presented the members of the French Anatomical Society with an arachnoid tumour having the size of a walnut. It was found by chance during the autopsy of a 77-year-old woman who had no symptoms. He called it a "fibroplastic tumour", amounting to "an epithelioma of the arachnoid". Victor Cornil (1837–1908) then made this remark: "Last year, I observed around fifteen of these tumours during the autopsies I carried out at La Salpêtrière Hospital. These tumours, which the Germans refer to as sarcoma of the dura mater, have no relation to cancer" [28]. When, in 1869, Jean-Martin Charcot (1825–1893), presented "a case of hemiplegia" by tumoural medullary compression, he concluded his anatomopathological chapter with a reference to "arenaceous tumours" [29], psammoma bodies, and angiolithic sarcomas, the last a term that Cornil and Louis Ranvier (1835–1922) had substituted for Virchow's psammoma [30]. Charcot did not indicate his preference for one or the other terms. In Italy, Camillo Golgi (1843–1926) proposed "endothelioma" as opposed to "epithelioma" [31]. Finally, in 1922 Harvey Cushing (1869–1939) proposed first the term "arachnoidal mesothelioma", then that of "meningo-

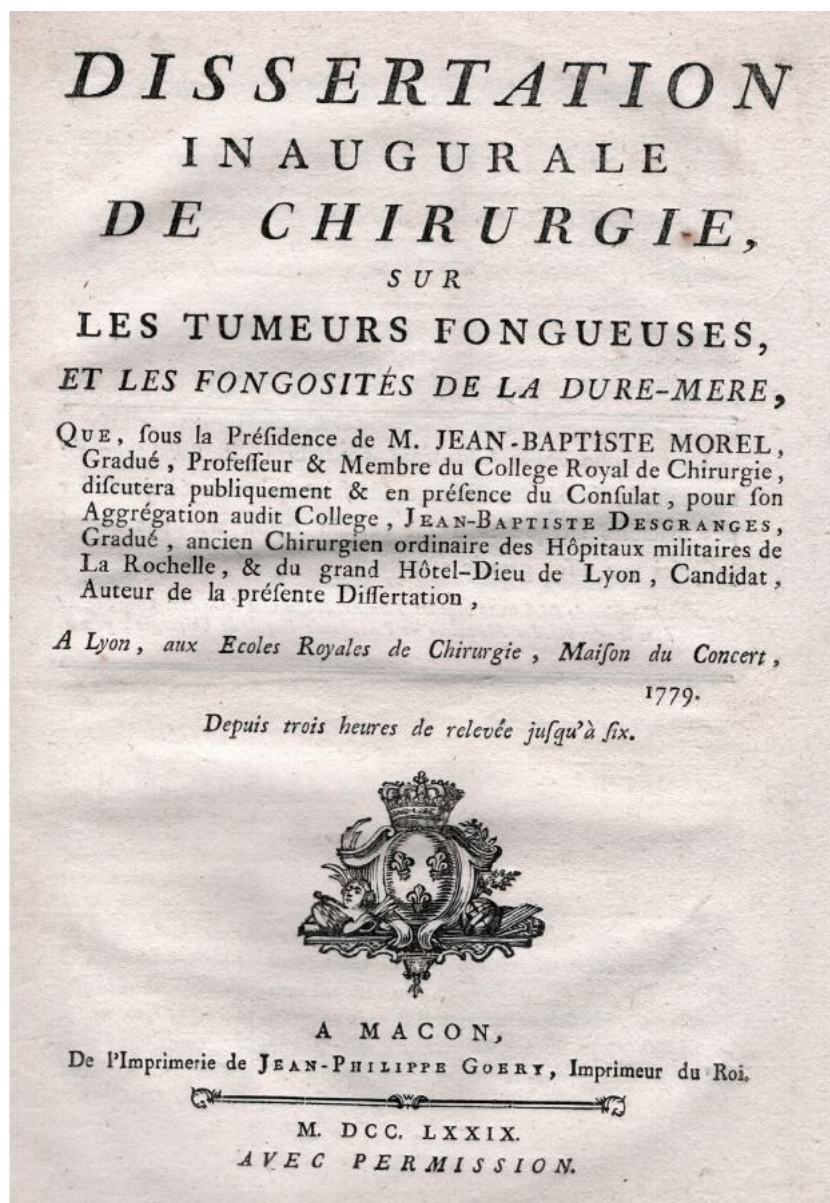


Fig. 6 – Cover of J.-B. Desgranges's thesis in 1779 (OW Collection).

thelioma". They were subsequently shortened to “meningioma”, which is the term that has been universally used from that time on [32].

8. Conclusion

A number of articles addressing meningiomas start with a brief reference to the dissertation of Antoine Louis, giving him credit for a pioneering description. The best example of this is the seminal article of 1938, dealing exclusively with meningiomas and written by Cushing and his neuropathologist Louise Eisenhardt (1891–1967) in 1938 [33]. This unanimous homage must not lead us to overlook the patients in the 18th and 19th centuries whose suffering, undoubtedly atrocious,

made it possible to initiate the progress that allows today's patients to benefit from surgery which, in most cases, saves them [34].

Statement of ethics

This work required no approval from an institutional review board and was prepared in accordance with the ethical guidelines of the journal.

Disclosure of interest

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