NEURO IMAGE

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HÔPITAL NEUROLOGIQUE DE MONTRÉAL
MONTREAL NEUROLOGICAL INSTITUTE

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The 100th anniversary of the first successful removal of a spinal cord tumour

By A.C.J. DE LOTBINIÈRE, BSC, MDCM

Exactly 100 years ago there appeared in the "Medico-Chirurgical Transactions" of the Royal Medical and Chirurgical Society of London a paper entitled, "A Case of Tumour of the Spinal Cord. Removal; Recovery." co-authored by William Gowers and Victor Horsley (see Fig. 1). William Gowers (1845-1915) (Fig. 2) had reached the age of forty-three and by then was already widely respected as an authority in the field of neurology, having published several monographs, including "Diagnosis of Diseases of the Spinal Cord" (1880). 1888 also marked the year in which the second volume of his famous "A Manual of Diseases of the Nervous System" was published, a classic textbook considered by many to be the "Bible of neurology". Victor Horsley (1857-1916) (Fig. 3) on the other hand was relatively unknown, having just been appointed Surgeon to the National Hospital for the Paralysed and Epileptic in 1886 at the age of twenty eight. Despite his relative youth he had been fortunate in being associated with Edward Schäfer, a physiologist interested in experimental studies on the effect of cortical ablations in monkeys. These studies, along with subsequent studies on the effect of electrical stimulation

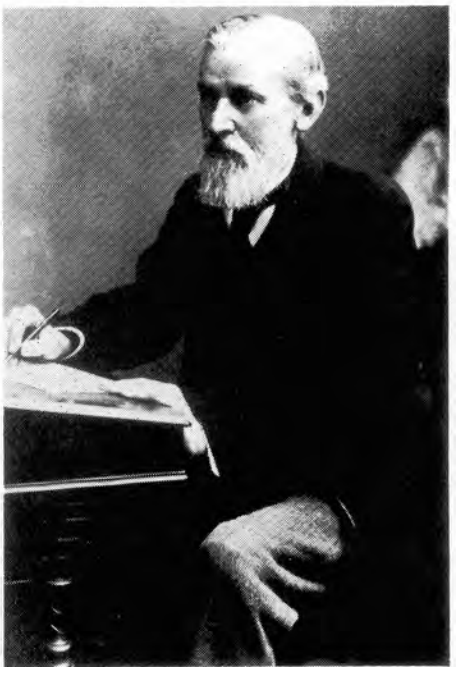


Figure 2

A CASE

OF

TUMOUR OF THE SPINAL CORD.

REMOVAL; RECOVERY.

BY

W. R. GOWERS, M.D., F.R.S.,

AND

VICTOR HORSLEY, B.S., F.R.S.

Received March 8th—Read June 12th, 1888.

Figure 1

Figure 3

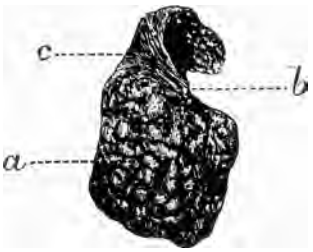
(carried out in collaboration with Charles Beevor at the Brown Institute, a hospital for animal research) gave Horsley an invaluable experience in the handling of nervous tissue and in the understanding of the physiology and anatomy of the nervous system. It is therefore not surprising that William Gowers sought out Victor Horsley's opinion in June 1887 regarding the feasibility of operating on a 43 year old army officer who presented with symptoms and signs of spinal cord compression.

Captain G.'s history extended back to 1884 when he began to experience what was diagnosed as "intercostal neuralgia" localized to a spot below the left scapula. Despite numerous remedies, including moxibustion, Turkish baths, Digitalis, Potassium of Iodide, and Morphia, the pain persisted and intensified to the point that he was severely incapacitated, the slightest movement causing severe paroxysms of pain. In February of 1887 he began to notice weakness in the legs, at first on the left and subsequently on the right. By April the weakness had progressed to complete loss of power accompanied by sensory changes and bladder dysfunction. Apparently some doubts were entertained as to the veracity of his complaints, one suggestion being made that he should be put through a course of the "Weir-Mitchell treatment". Upon the advice of Sir William Jenner, he was referred to William Gowers at Queen Square. William Gowers saw the patient on June 5th and described the examination as follows:

> "There was absolute palsy of the legs, and cutaneous sensibility of all kinds was lost as high as the ensiform cartilage. At and just above this level, that is, in the region of the 6th and 7th intercostal nerves, he complained of severe pain around the chest, much more severe on the left side than on the right, that increased to evident agony on any movement. The legs from time to time became rigid in extensor spasm, and a clonus could be obtained with great readiness in the muscles of the calf and front of the thigh. The paroxysms of spasm involved also the muscles of the abdomen. The bladder was distended, and the urine that was drawn off contained pus. There was no irregularity of vertebral column, nor could tenderness be discovered in any part. No trace of pulsation could be felt in its vicinity, and no murmur could be heard on auscultation. The thoracic organs seemed healthy, and both lungs were equally filled with air."

He concluded that the symptoms were characteristic of a transverse lesion of the spinal cord situated "a little above the middle of the dorsal region. The gradual onset of the paralysis, the affection of one leg before the other, and the long proceding signs of nerve irritation at the level of the lesion, made it practically certain that the spinal cord was damaged by compression and that the cause of the pressure was outside the cord itself."

Victor Horsley saw the patient at 1 p.m. on June 9th, and at 3.30 p.m. "kindly assisted by Mr. Stedman and Mr. Ballance" operated upon the patient in the semi-prone position while the patient was anesthetized with ether. A laminectomy from T.4 to T.6 was performed disclosing a normal spinal cord. Further removal of the lamina above and below failed to reveal any growth and "at this juncture it appeared as if sufficient had been done". However, Charles Ballance



Photograph of the tumour, the natural size.

a. Points to the lobulated surface of the solid portion of the tumour, this producing the excavation of the cord.

b. Points to the open cavity in the tumour, this cavity being ruptured during the removal of the mass.

c. Shows the fibrous capsule forming part of the inner wall of the cystic cavity, and consisting of simple connective tissue, thus contrasting with the myxomatous tissue at *a*.

Figure 4

(1850-1930) urged Horsley to further expose the spinal cord and consequently another lamina was removed at the upper part of the incision. "On opening the dura mater I saw on the left side of the subdural cavity a round, dark, bluish mass about three millimeters in diameter, resting upon the left lateral column and posterior root-zone of the spinal cord". Horsley removed a further lamina disclosing the entirety of the tumor which appeared to be attached inferiorly to the left fourth thoracic nerve, the tumour causing marked compression of the spinal cord (Fig. 4). Microscopic examination revealed a tumour consistent with a benign "fibromyxoma".

The patient's post-operative course was meticulously documented by Horsley: by the 10th day following the operation sensation had returned to the lower limbs; this was followed a few days later by the return of voluntary movement initially in the right and subsequently in the left lower extremity. He was discharged from hospital on August 13th having recovered control of his bladder and rectum. He was seen again in January 1988 and, despite a spastic gait, he was able to walk "three miles with ease". The year following surgery he wrote to Victor Horsley stating that he was in excellent health, putting in sixteen hours a day of work "including much standing and moving about".

Victor Horsley concluded his paper with a discussion of the method of operating upon the spine and a review of the 58 cases of spinal meningeal tumours previously published in the literature. For both intradural and extradural growths the progression of symptoms was clearly "Pain, Motor paralysis, Sensory paralysis". In reviewing the cases he concluded that,

> "... in no less than 74% of the extradural growths, and 83% of intradural, the patient died simply from indirect effects of the tumours, i.e. from exhaustion (in a very large number of cases), owing to pain, etc. or from pyaemia owing to absorption from the bed sores, or from septic pneumonia, or from acute septic interstitial nephritis. Roughly speaking, therefore, about 80% of these miserable cases could have been relieved entirely by operation, and those which were hopeless might by relief of pressure have been granted a euthanasia."

Victor Horsley's subsequent career marked him out as a pioneer in the field of neurological surgery. By 1890, at the International Medical Congress in Berlin, he was able to report the results of 44 operations on the brain. His skills as an experimental neurophysiologist were no less remarkable and were undoubtedly responsible for his prompting R.H. Clarke, physiologist at St. George's Hospital in London, in building a stereotaxic instrument for the study of cerebral function in the experimental animal. However, he will be best remembered as the person who showed that operations on the brain and spinal cord could be performed safely with an acceptable morbidity and mortality thereby paving the way for the specialty of neurosurgery.

Reference:
Medico-Chirurgical Transactions 1888. Series II: 53: 377-428.

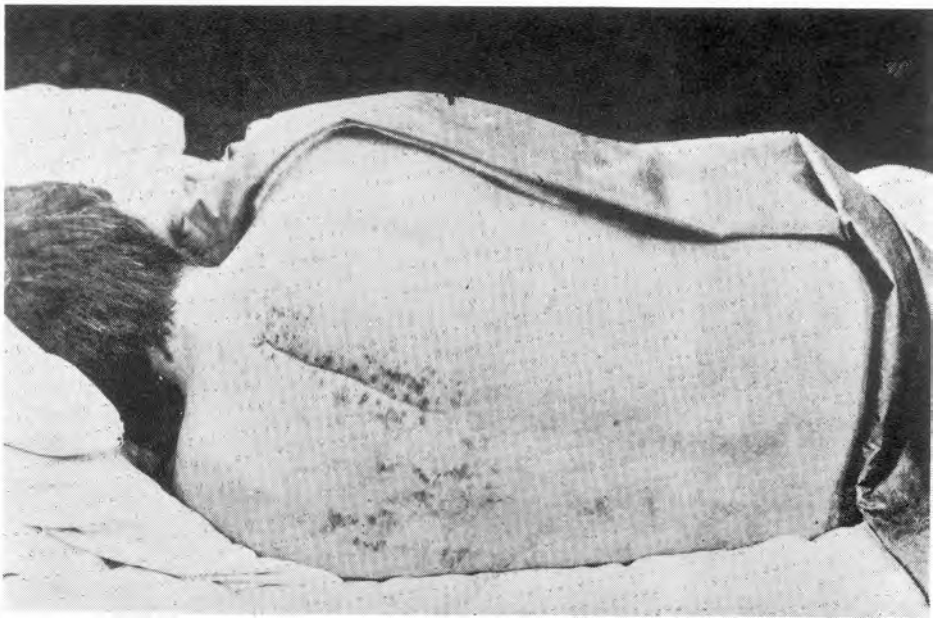


Figure 5 — The laminectomy incision photographed approximately seven weeks after the operation.

Hemorrhagic infarct in the frontal lobe

D. TAMPIERI, D. MELANSON

b

This 68 year old right handed man developped aphasia eleven days prior to the admission in our Institution. On CT scan (a) an intracerebral hematoma surrounded by oedema was visualized in the left frontal parasagittal region. The MR, done 12 days after the episode, showed an inhomogenous area of high intensity signal with an isointense center in the T1 weighted image (b). These findings were consistent with a hematoma in the subacute phase formed by peripheral methemoglobin and center of intracellular deoxyhemoglobin. The angiographic studies, one performed at the admission, the other 5 weeks later, did not demonstrate any evidence of vascular malformation. A repeated CT showed an hypodense lesion in the left frontal paramedian region with a vascular pattern in the territory of distribution of the anterior cerebral artery (c). This last exam confirmed the diagnosis of hemorrhagic infarct in the territory of the left anterior cerebral artery.

a

c

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Amygdaloid Seizures with Automatism and Amnesia:

Centenary of a Concept — from Hughlings-Jackson to MRI*

By WILLIAM FEINDEL, OC, MDCM, DPhil.**

In the journal **Brain** just 100 years ago, J. Hughlings-Jackson published a clinical report entitled, "On a particular variety of epilepsy ('intellectual aura'), one case with symptoms of organic brain desease." His concept of "uncinate fits" — this particular variety of epilepsy — placed on firm ground the association of attacks of automatism and amnesia with pathology involving the temporal lobe. He was much influenced in this localization by the results of temporal lobe stimulation and ablation in monkeys described by Ferrier in 1876, and by several accounts where temporal lobe tumours had been associated with attacks of dreamy state and olfactory hallucination. But it was the one case of "Dr. Z." where a small cystic lesion at post mortem was restricted to the uncinate gyrus (Jackson and Colman, 1898) that led to the crucial support of Jackson's thesis. (Fig. 1A and 1B). And in 1899 with Stewart, Jackson argued "That the discharge lesions in these cases are made up of some cells, not of the uncinate gyrus alone, but of some cells of different parts of a region of which this gyrus is a part — a very vague circumscription, the uncinate region. In cases of this group there is at the onset of the paroxysms a crude sensation of smell or one of taste or there are movements of chewing, or

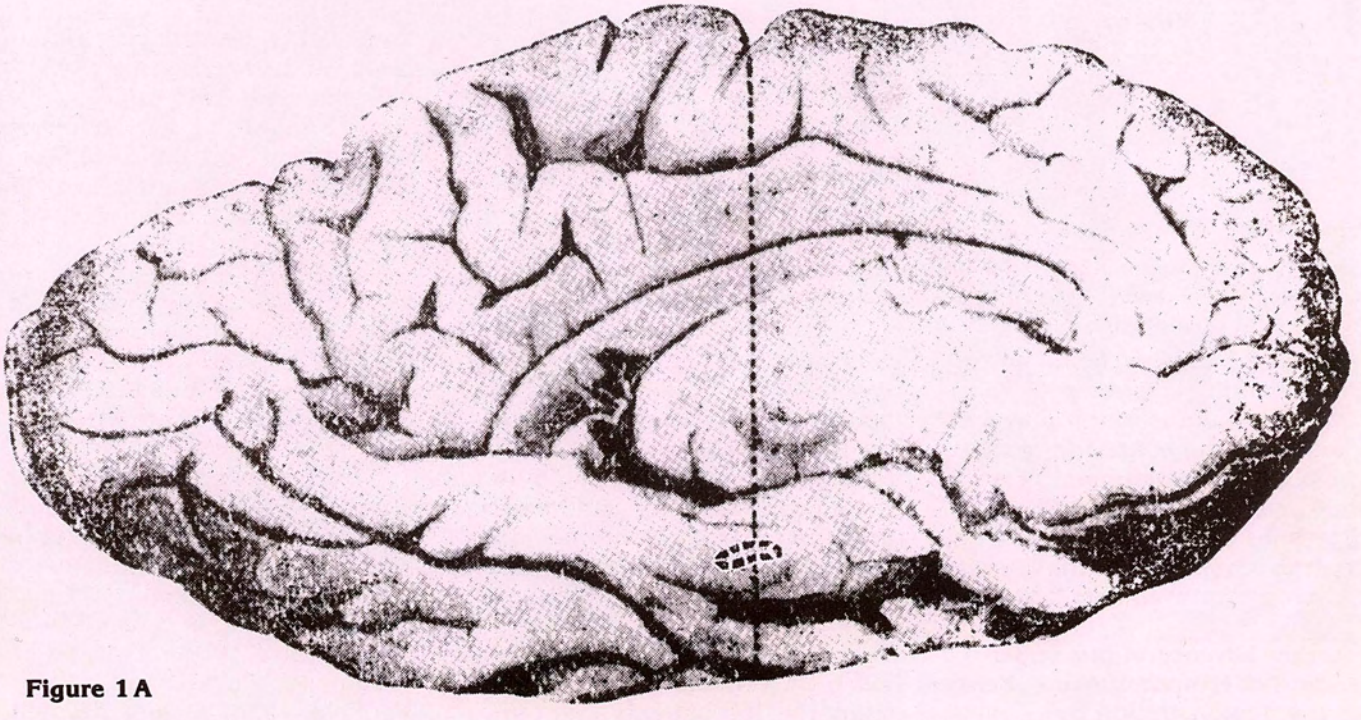


Figure 1A

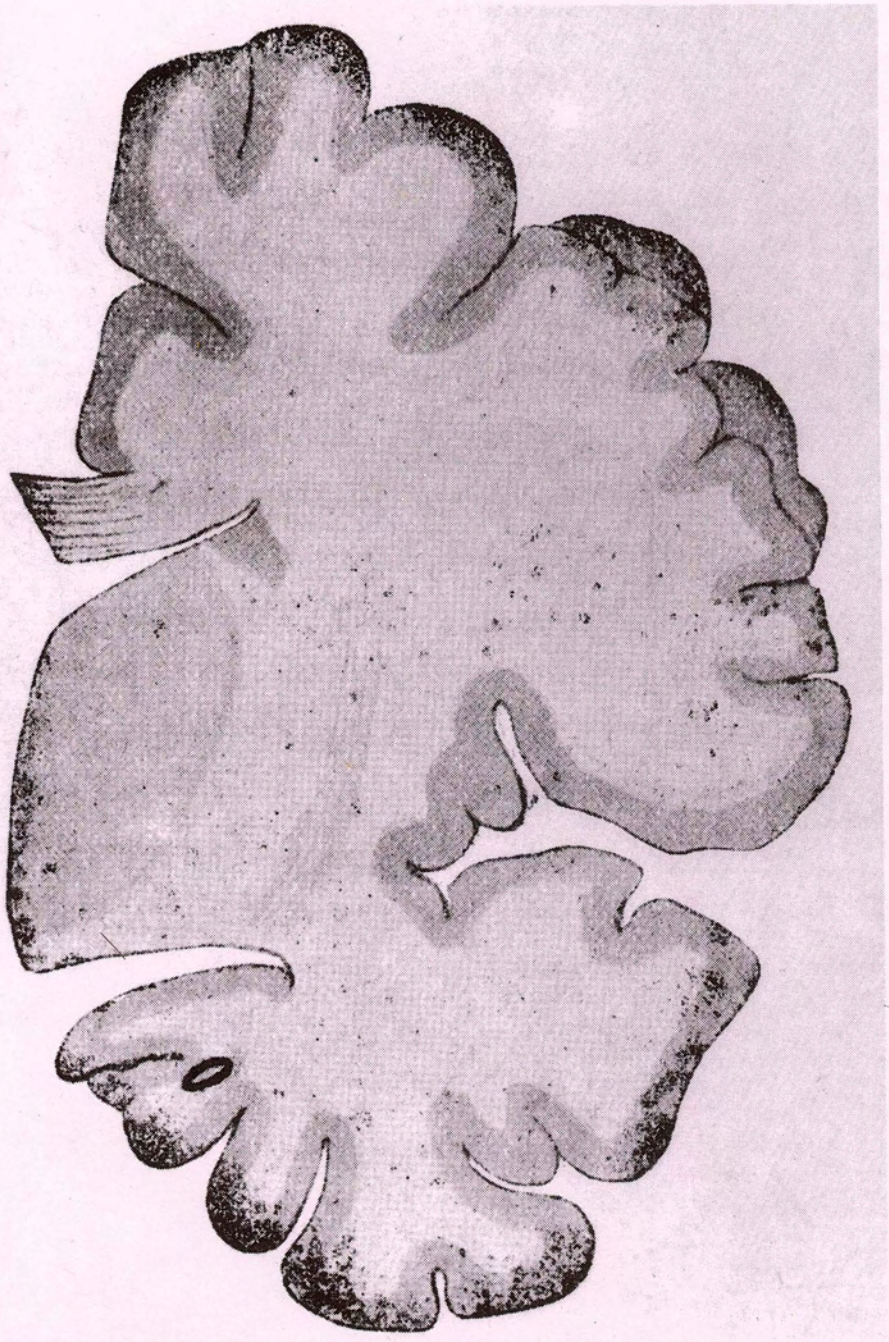


Figure 1B

Figure 1 — A small patch of softening in the left uncinate gyrus shown on (A) the mesial aspect, and (B) the coronal section of the temporal lobe (from Jackson and Colman, 1898).

smacking of the lips, (sometimes there is spitting). In some cases of this group there is warning by what is known as the epigastric sensation, a crude development of a systemic sensation; this warning sometimes occurs along with a sensation of smell or with the chewing or smacking movements".

A further advance in our understanding of temporal lobe epilepsy was the demonstration by Gibbs's and Lennox (1938), Jasper and Kershman (1941), and Jasper and Daly (1947) that the electrographic localization in patients with temporal lobe seizures could be restricted to an anterior temporal or anterior sylvian region. This idea of lobar temporal localization was less precise than Jackson's view.

That was the situation when, in 1951, Dr. Penfield encouraged me to study the 155 patients with temporal lobe epilepsy, especially those with automatism and amnesia who had undergone operation, mostly temporal corticectomy, in the preceding ten years (Penfield and Flanigan, 1950). Analysis of the seizure patterns in 50 of these patients showed that a variety of features preceded automatism, the most common being sensation, conscious confusion, motor features, and some type of head sensation. Of note especially was the dreamy, far-away feeling (emphasized by Hughlings-Jackson) as well as a sense of fear, flushing or pallor of the face and auditory or visual hallucinations (Feindel and Penfield, 1954).

Armed with this detailed information we then observed in the operating room in patients under local anesthesia during surgical treatment, the responses to cortical and deep temporal stimulation. During that year, in 16 patients, we were able to produce the typical features of temporal automatism with sometimes striking corticographic ictal changes. The anatomical sites for the stimulation clustered in and about the amygdala (Fig. 2).

The functional implications of our findings in the operating room were most intriguing; that the amygdala could serve as the generator of temporal lobe seizures, the hallmarks of which were automatism and amnesia. A search of the literature and especially the writings of Hughlings-Jackson, turned up this case of "Dr. Z." who resembled our first reported case P. Sa., with a hamartoma in the amygdala (Feindel and Penfield, 1954).*** The results were all the more exciting to me, having just returned to the MNI from three years at Oxford in the Department of Human Anatomy with Le Gros Clark. He had investigated in the monkey the anatomical connections of the temporal lobe (Clark, 1936) and was studying with Margaret Meyer, the central connections of the olfactory system. Also in the Department was Alf Brodal as a visiting professor, completing his extensive review on the function of the hippocampus (Brodal, 1947a) and the amygdaloid nucleus (Brodal, 1947b). So a substantial part of our final paper (Feindel and Penfield, 1954) became devoted to

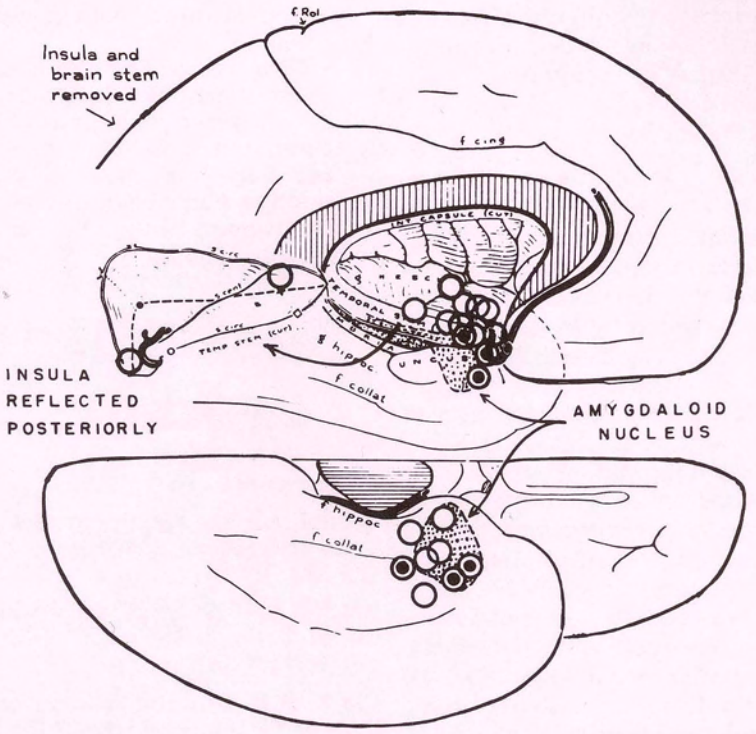


Figure 2 — Sites clustered about the amygdala, where stimulation at operation producing features of automatism and amnesia. (Feindel and Penfield, 1954).

the anatomy of the amygdala and its powerful connections.

The electrographic findings at operation included the important demonstration of low voltage fast activity and suppression of cortical spiking during the induced ictus (Feindel, Penfield and Jasper, 1952). In the laboratory, Pierre Gloor and I were able to reproduce this circumstance by amygdala stimulation in cats. (Feindel, Gloor and Penfield, 1953, Feindel and Gloor, 1954). Subsequent experimental studies of the amygdala amply confirmed in detail the important physiological role of this structure. (Gloor, 1957, Gloor and Feindel, 1963).

The immediate logical conclusion from our study in 1951 was that surgical excision must include the amygdala to secure satisfactory relief of seizures. Whether the hippocampus should also be included with that removal, as emphasized by Falconer (1968) and so many other surgeons even up to the present time, is a controversial point that still demands scientific clarification. When Brenda Milner, with Penfield and Scoville, emphasized the risks to memory function of hippocampal removal, it appeared even more advantageous to focus on excision of the amygdala, but to keep the hippocampal section to a minimum, based on its electrographic abnormality recorded at the time of operation.

Recent studies by Gloor, Olivier et al (1982) demonstrated more elegantly how hallucinatory and illusory phenomena can be produced by

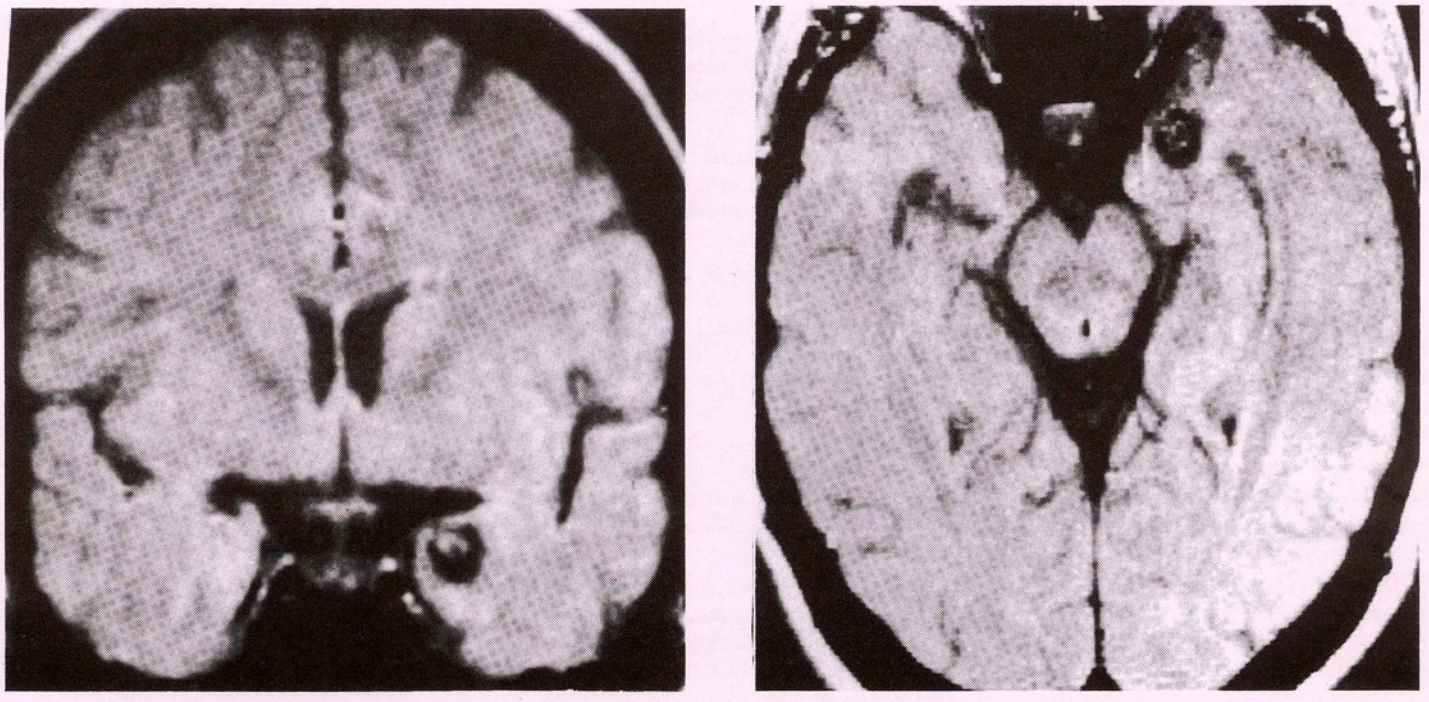


Figure 3 — MRI coronal (A) and (B) transverse planes of patient MQ showing a small venous angioma in the left uncinate region (amygdala).

stimulation of the amygdala but only uncommonly from the hippocampus. They used the more precise localization of stimulus by stereotaxically placed depth electrodes in the mesial temporal structures.

Further validation of our concept of the amygdaloid nucleus in the genesis of temporal lobe automatism has now been provided by magnetic resonance imaging. Small structural lesions have repeatedly been shown in and immediately about the amygdala. Moreover, at 1.5 Tesla and suitable imaging parameters, increased signal intensity in the mesial temporal region has matched severe gliosis in the amygdala excised at operation (Feindel, Robitaille et al, 1988). A typical example of the value of MRI is provided by the patient M.Q., who had attacks of automatism ushered in by an odd smell followed by amnesia. On MRI, a 1.5 centimeter lesion in the left uncus and amygdala closely resembled the finding in Jackson's "Dr. Z.". On removal this proved to be a venous angioma. (Fig. 3)

These findings vindicate Hughlings-Jackson's original proposal about uncinate attacks. They substantiate our hypothesis, based on stimulation and surgical findings in 1951, which has since been confirmed many times, of the critical role of the amygdala in attacks of automatism and amnesia characteristic of many temporal lobe seizures (Feindel, 1986).

But much work remains to be done on this complex subject. For example, the pathogenesis of the severe atrophy of the first temporal convolution seen so often at operation, has to be explained. The reasons for the selective damage to the mesial temporal structures require more examination; the basis of surgical success and failure will confront us with continuing questions (Feindel, 1975). So we can agree with Thomas Willis when he wrote, in 1667, "As the symptoms of epilepsie are very stupendious, so their causes, and the formal reason of the disease itself, are most difficult to be unfolded."

* From the McConnell Brain Imaging Centre, Montreal Neurological Institute.
** William Vernon Cone Professor of Neurosurgery, McGill University.
*** The operative photograph of P. Sa. became the frontispiece of Penfield and Jasper's monograph, **Epilepsy and the Functional Anatomy of the Human Brain.** Little, Brown: Boston, 1954.

References:

Brodal, A.: The hippocampus and the sense of smell. A review. Brain. *70:* 179-222, 1947a.

Brodal, A.: The amygdaloid nucleus in the rat. J. Comp. Neurol. *87:* 1-16, 1947b.

Clark, W.E. Le.: The thalamic connections of the temporal lobe of the brain in the monkey. J. Anat. (Lond). *70:* 447-464, 1936.

Falconer, M.A.: The significance of mesial temporal sclerosis (Ammon horn sclerosis) in epilepsy. Guy's Hosp. Rep. *117:* 1-12, 1968.

Feindel, W., and Gloor, P.: Comparison of electrographic effects of stimulation of the amygdala and brain stem reticular formation in cats. Electroenceph. clin. Neurophysiol. *6:* 389-402, 1954.

Feindel, W. and Penfield, W.: Localization of discharge in temporal lobe automatism. Arch. Neurol. Psychiat. (Chic). *72:* 605-630, 1954.

Feindel, W., Penfield, W., and Jasper, H.: Localization of epileptic discharge in temporal lobe automatism. Trans. Amer. Neurol. Soc. *77:* 14-17, 1952.

Feindel, W., Gloor, P. and Penfield, W.G.: Diffuse electrocorticographic effects produced by stimulation of the amygdaloid region in human subjects and cats. Proc. IXX International Physiol. Cong; 343, 1953.

Feindel, W.: The significance of the amygdala in the surgery of temporal lobe seizures. IV Edwin B. Boldrey Lecture. University of California, San Francisco. February 1986.

Feindel, W.: Factors contributing to the success of failure or surgical intervention for epilepsy. In: *Advances in Neurology. 8:* 281-298, 1975. (Eds.) D.P. Purpura et al. New York, Raven Press.

Feindel, W.: Temporal lobe seizures. In: *Handbook of Clinical Neurology*. Ch. 5, *15:* 87-106, 1974. (Eds.) O. Magnus and A.M. Lorentz de Haas. Amsterdam. North-Holland Publishing.

Feindel, W., Robitaille, Y., Ethier, R. and Quesney, L.F.: Role of the amygdala in the surgery of temporal seizures: further evidence from magnetic resonance imaging and surgical pathology. To be presented at the American Association of Neurological Surgeons. April 1988.

Gibbs, F.A., Gibbs, E.L. and Lennox, W.G.: Likeness of the cortical dysrhythmias of schizophrenia and psychomotor epilepsy. Amer. J. psychiat. *95:* 255-269, 1938.

Gloor, P., Olivier, A., Quesney, L.F., Andermann, F. and Horowitz, S.: The role of the limbic system in experiential phenomena of temporal lobe epilepsy. Ann. Neurol. *12:* 129-144, 1982.

Gloor, P., and Feindel, W.: Affective behaviour and temporal lobe. In: *Physiologie und Pathophysiologie des Vegetativen Nervensystems. II:* 685-716, 1963. (Éd.) M. Monnier. Stuttgart-Hippokrates.

Jackson, J.H.: On a particular variety of epilepsy ('Intellectual aura'): One case with symptoms of organic brain disease. Brain. *11:* 179-207, 1888.

Jackson, J.H. and Colman, W.S.: Case of epilepsy with tasting movements and "dreamy state" — Very small patch of softening in the left uncinate gyrus. Brain. *21:* 580-590, 1898.

Jackson, J.H., and Stewart, P.: Epileptic attacks with a warning of crude sensation of smell and with intellectual aura (dreamy state) in a patient who had symptoms pointing to gross organic disease of the right temporo-sphenoidal lobe. Brain. *22:* 334-549, 1899.

Jasper, H.H., and Daly, D.: Suppression of the electroencephalogram during the onset of an epileptic seizure. Proc. Amer. Soc. Electroenceph. June (1947).

Jasper, H.H., and Kershman, J.: Electroencephalographic classification of the epilepsies. Arch. Neurol. Psychiat. (Chic). *45:* 903-943, 1941.

Penfield, W., and Flanigan, H.: Surgical therapy of temporal lobe seizures. Arch. Neurol. Psychiat. (Chic). *64:* 491-500, 1950.

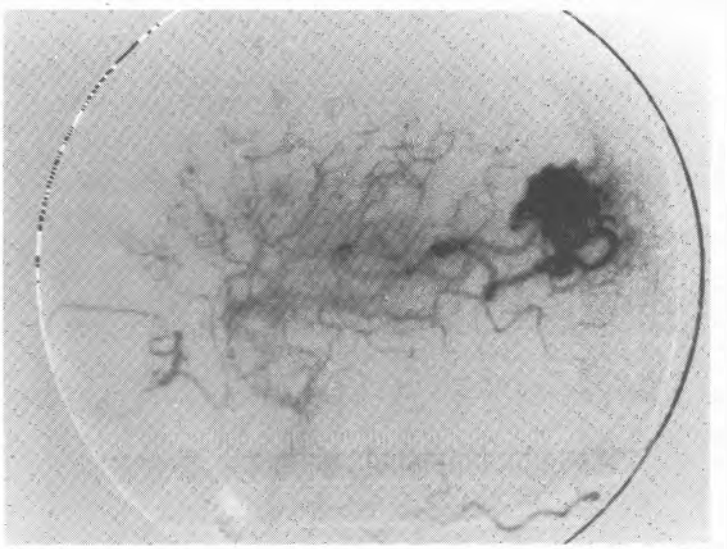
Penfield, W., and Milner, B.: Memory deficit produced by bilateral lesions in the hippocampal zone. Arch. Neurol. Psychiat. (Chic.) *79:* 475-479, 1958.

Willis, T.: Of the Epilepsy or Falling Sickness. In: An essay of the pathology of the brain and nervous stock in which convulsive diseases are treated of. Pordage translation of 'Pathologiae cerebri' (1667). London, T. Dring (1681).

Radiosurgery of angiomas

ANDRÉ OLIVIER, neurosurgeon
DONATELLA TAMPIERI, neuroradiologist

In a recent issue of our magazine, we reported on the future of stereotaxic focal high field radiation therapy of angiomas and showed a first positive result. We are showing here in this current issue an example of complete cure of such a lesion on angiography (Fig. 1) and the different signals produced on magnetic resonance (Fig. 2). We think that our readers should be aware of this alternative/complement to conventional interventional and surgical treatments.



▲ Figure. 1a b ▼

Figure 1a, b — Carotid angiography: the parietal angioma (Fig. 1a) is not seen 6 months after radiosurgery (Fig. 1b).

Figure 2a, b, c
a: the T1 image shows multiple serpiginous void signals consistent with an AVM
b: after treatment, the T1 image shows an area of inhomogeneous signal. The high intensity signal is due to the free methemoglobin surrounded by a low intensity signal consistent with gliosis, and hemosiderin.
c: the proton density image displays the gliosis (high intensity signal) and the hemosiderin deposit (crescentic area of void signal)

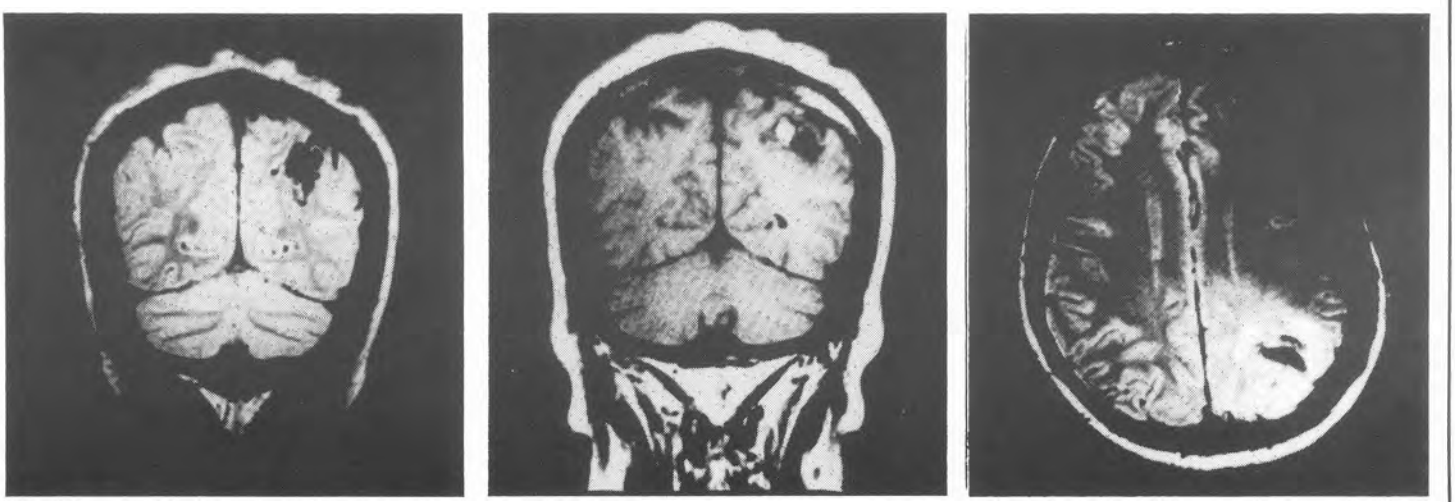
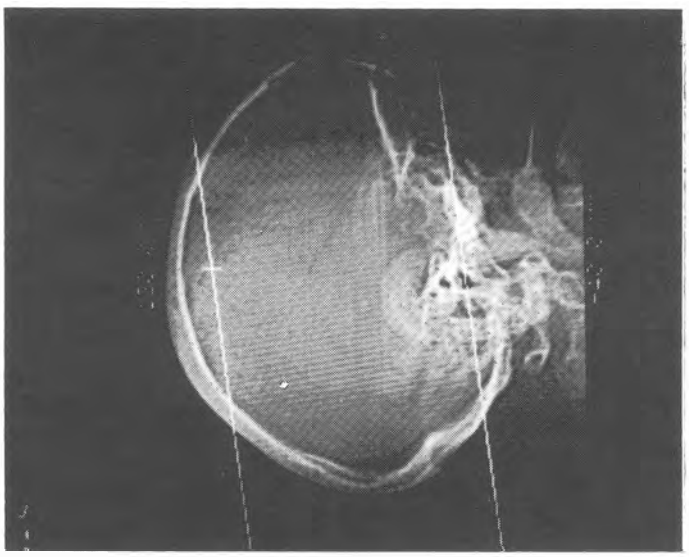


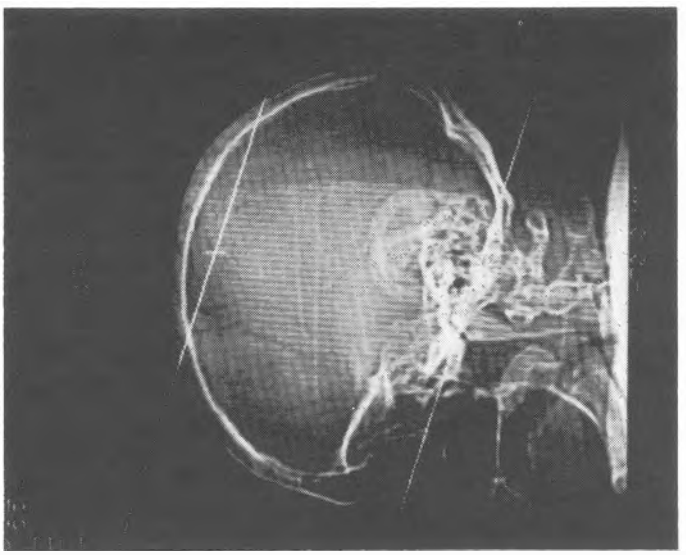
Figure 2a **b** **c**

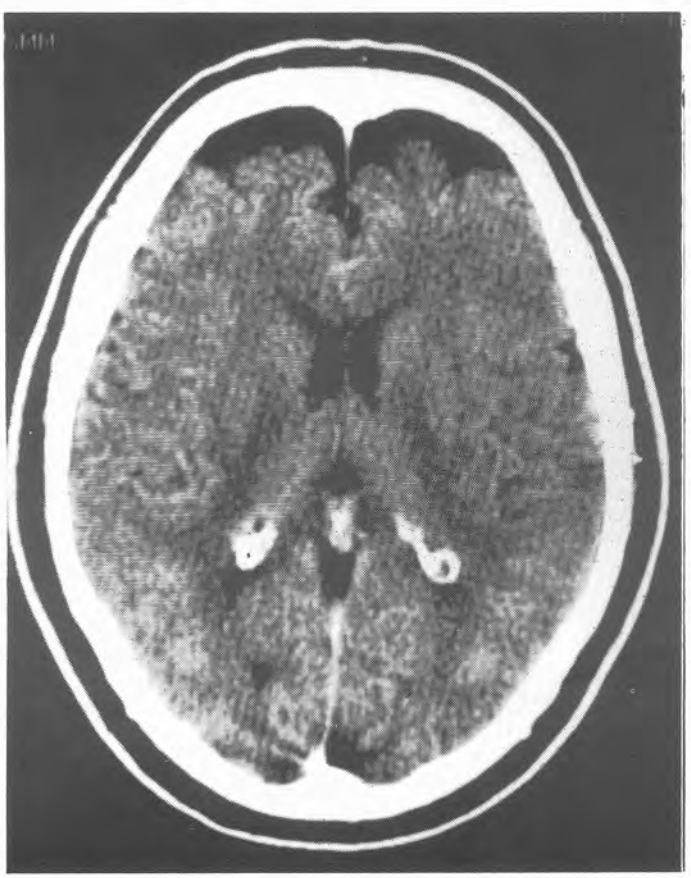
The frontal subdural hygroma: prone versus supine position

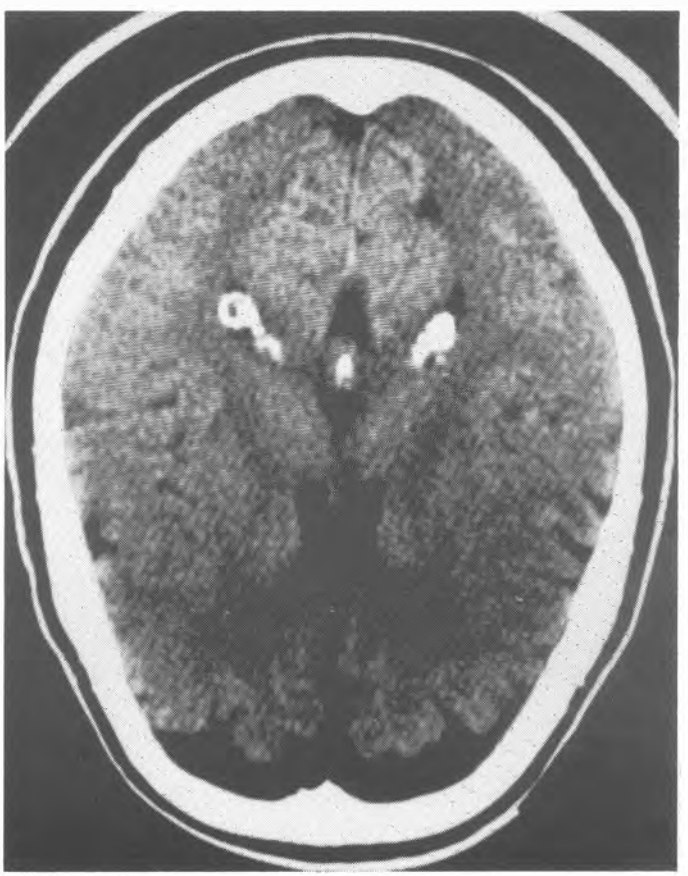
DONATELLA TAMPIERI, DENIS MELANÇON

It is difficult sometimes to convince the clinician that his patient has a thin collection of subdural fluid over the frontal poles; it is usually differentiated from atrophy by the lack of dilated sulci adjacent to the hypodensity of the subdural fluid. If the scan is repeated in the prone position and the brain fails to abut the inner table of the skull, the proof of the subdural location of the fluid is obtained. We are showing images of such a demonstration.









Supine position

Prone position

White matter changes in the aging brain

PIERRE-ANDRÉ DELPLA, M.D.

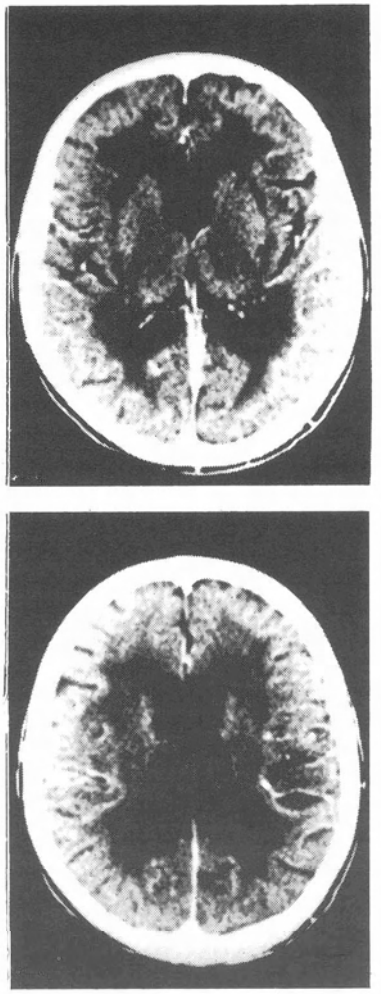
Since the advent of CT scan, periventricular white matter (PVWM) lucencies, of variable extent, are commonly and often incidentally observed over the age of 50.

Similarly, on MR imaging, the presence of periventricular hyperintensities of T2 weighted images is even more frequent.

Apart from rare or easily recognizable diseases such as normal pressure hydrocephalus, multiple sclerosis and leukodystrophies or diffuse cerebral hypoxia due to bilateral carotid lesions or severe cardiac disease, such findings have been mainly referred to subcortical arteriosclerotic encephalopathy. This rare entity, first described by Binswanger in 1894, is characterized by a slowly progressive dementia and acute focal or subacute neurological symptoms, typically in hypertensive individuals.

Interestingly the discrepancy between the frequency and the clinical features of this condition and those of PVWM changes (sometimes correlated to no neurological symptoms) has led many authors to the conclusion that these latter probably corresponded to early stages of Binswanger's disease.

However, the observation of similar imaging anomalies in normal elderly subjects with no known risk factors as well as in dementias of the Alzheimer's type suggest that other vascular leukoencephalopathies may occur with aging: amyloïd angiopathy is one of them.



Substance blanche et vieillissement cérébral

PIERRE-ANDRÉ DELPLA, M.D.

La découverte, parfois fortuite, en CT scan d'hypodensités plus ou moins confluentes de la substance blanche périventriculaire est fréquente au delà de 50 ans.

L'IRM, plus sensible mais peut-être moins spécifique, révèle plus souvent encore sur les images pondérées en T2, des hyperintensités périventriculaires similaires.

Si l'on fait abstraction d'affections rares ou habituellement identifiables par leur contexte clinique et l'imagerie elle-même (hydrocéphalie normotensive, sclérose en plaques et leucodystrophies, infarctus jonctionnels d'origine carotidienne ou systémique), l'étiologie le plus souvent retenue est une atteinte des petits vaisseaux (lipohyalinose) fortement corrélée à l'hypertension artérielle telle que le réalise l'encéphalopathie artérioscléreuse chronique ou Maladie de Binswanger.

S'agissant d'une pathologie classiquement rare (moins de 50 cas rapportés dans la littérature) et dont la traduction clinique habituelle est une démence progressive généralement émaillée d'épisodes neurologiques focaux, les anomalies de l'imagerie cérébrale compatibles avec ce diagnostic, beaucoup plus fréquentes et parfois cliniquement silencieuses, pourraient représenter des stades précoces, voire infracliniques de l'affection.

Cependant, la constatation de changements similaires de la substance blanche chez des sujets âgés dépourvus de facteurs de risque vasculaire et chez des déments de type Alzheimer fait supposer l'intervention d'autres leucoencéphalopathies artériopathiques: l'angiopathie amyloïde en est un exemple.

1. Valentine AR et al: White Matter abnormality in cerebral atrophy: clinicoradiological correlations. J NEURO NEUROSURG PSYCHIATRY 1980, 43:139-142
2. Goto K et al: Diffuse white matter disease in the geriatric population: a clinical neuropathological and CT study. RADIOLOGY 1981, 141:687-695
3. Bradley WG et al: Patchy periventricular white matter lesions in the elderly: common observation during NMR Imaging. NON-INVASIVE MED IMAGING 1984, 1:35:41
4. George AE et: Leukoencephalopathy in normal and pathological aging: 1) CT of brain lucencies 2) MRI of brain lucencies AJNR 1986, 7:561-566; 567-570
5. Sarpel G et al: Magnetic resonance imaging of periventricular hyperintensity in a Veterans' Administration Hospital population. ARCH NEUROL 1987, 44:725-728
6. Hachinski VC et al: Leukoaraiosis ARCH NEUROL 1987, 44: 21-23
7. Drayer BP: Imaging of the aging brain: 1) normal findings 2) pathological findings RADIOLOGY 1988, 166: 785-796

Follow-up note on Children of the Brain

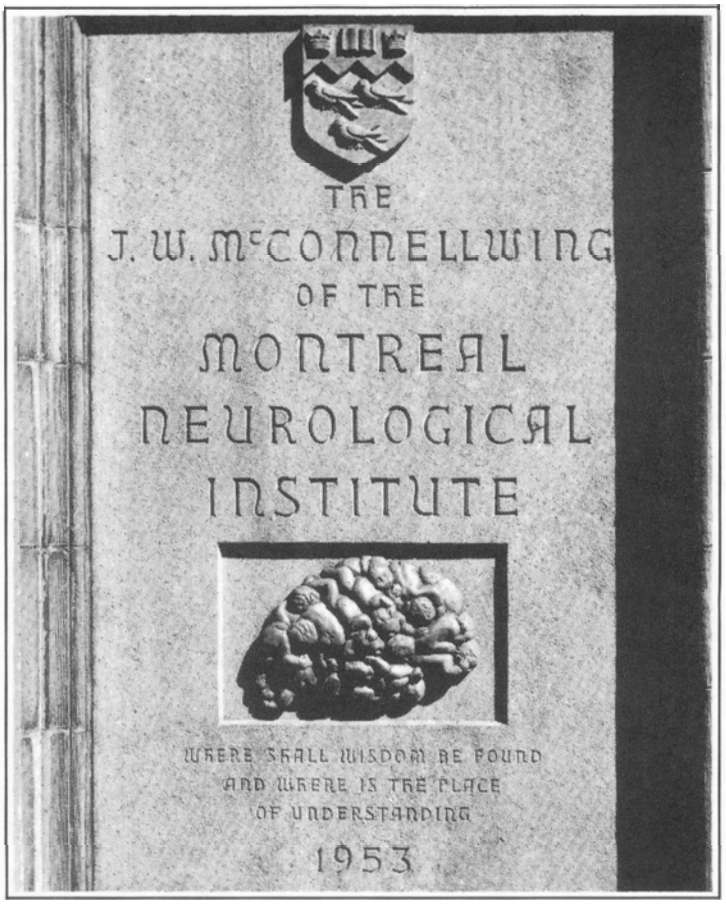
Some readers noted the mixed legends for Professors Edinger and Ariëns Kappers. Jean-Jacques Dreifuss who worked here with Peter Gloor 1965 to 1967 and is Professor of Physiology at the University of Geneva, kindly sent a reference to **Die Karikatur und Satire in der Medizin** by Eugen Holländer with a copy of the original sketch of the Brain Children reproduced from the album of Edinger, 1886, where it is clearly identified with Edinger as the artist at the age of 31.

Dr. Sidney Fisher, the Shakespearean scholar, from his first edition of the **Sonnets** (1609), has provided the original spelling which includes "waste blacks" instead of "blanks", the change having been made by Louis Theobold in 1731 and followed by all subsequent Shakespearean editors.

The correct position of the somewhat mobile umlaut should read Ariëns Kappers.

We thank our correspondents for their interest.

W.F.



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Friends and colleagues of Donald L. McRae may wish to show their gratitude for his influence and teaching in the field of Neuroradiology.

The proceeds of this fund will be used to promote education in this field, specifically, to develop new techniques in Interventional Radiology and to support the McRae Lecture in Neuro-Imaging.

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