

THE HISTORY OF EPILEPSY¹

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If I wished to show a student the difficulties of getting at truth from medical experience, I would give him the history of epilepsy to read.
—Oliver Wendall Holmes.

No disease appears to have made so deep or fearful an impression on the popular mind as epilepsy. In this paper an attempt is made to trace the thoughts, superstitions and investigations surrounding this disease from the time of the ancient Greeks, who left us the earliest Western writings on epilepsy. Historical perspective seems to end and present debate begins about the year 1880, when the impact of Hughlings Jackson's and Charot's work made itself felt. These men confined epilepsy to the realm of modern neurology, thus dispelling the vague concept of the **falling sickness**.

ANTIQUITY

The medical literature of the ancients may be approached from three points of view: (1) The clinical picture, (2) Pathological Theories, (3) Treatment.

The Clinical Picture

(a) **Definition** "Epilepsy is an illness of various shapes and horrible, said Aretaeus in the second century A. D. Hence, the many disease variations were recognized by the ancients. "But if there is not only convulsion of the whole body, but also interruption of the leading functions, then this is called **epilepsy**," said Galen.

(b) **Etiology**. It was commonly recognized that epilepsy was found most frequently in the early period of life. Its appearance for the first time after the age of twenty was deemed exceptional, and it was maintained that epilepsy was hereditary in etiology. The disease was thought to occur more often in men than in women. The epileptic attack was compared to the sexual act and both

Hippocrates and Democritus were credited with the saying that "coitus is a slight epileptic attack."

Climatic factors were also carefully considered. It was felt that sudden chilling after previous warming of the head and sudden change from a south to a north wind were fatal for children; while for aged people, spring and especially winter were most dangerous. Summer, lacking sudden climatic changes, was comparatively safe.

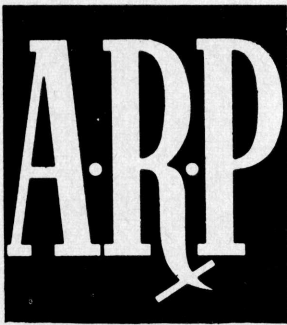
Regarding food, a great number of dishes were considered harmful, and their avoidance, as will be seen later, formed a chief part of the treatment of the disease. In general, digestive trouble was believed to be a prime factor. Great attention was paid to the consumption of wine, and drunkenness was one of the causes of epilepsy.

Among the psychic causes, overwhelming fright and anger were recognized as factors in children; more particularly, fright caused by something invisible, or fear when someone shouted.

(c) **Aura**. This word, taken from the Greek, originally meant a "breeze," and at first connoted one particular type of sensation with which the attack began. Besides the "breeze," the ancients knew many others premonitory signs, - tactile, sensory, motor and psychic. Soranus gave the following list of symptoms which he thought characterized the onset of epilepsy: heaviness and giddiness in the head, an inner noise, ringing in the ears, fiery circles before the eyes, continuous sleeplessness, erection without evident reason and frequent indulgence in sexual intercourse. The classification of premonitory signs according to the supposed starting point of the seizure was greatly emphasized by Galen and his successors. Such signs as heaviness of the head, dizziness, weak sight and dullness would indicate the brain as the seat of the disease. Sensations in the stomach region would point to that organ being primarily

¹Adapted from a presentation given to Alpha Omega Alpha, October 25, 1966.

²4th. year medicine.



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affected. Various reasons made the ancients pay a great deal of attention to these premonitory signs. Ligatures might postpone an attack which announced itself in a limb; the place of origin was thought to be prognostically significant, origin in the head having the worst omen, with the hands and feet being the best points of origination; realization of the impending attack might save the patient from danger, giving him time to choose a place where he could fall safely and without disgrace.

(d) **The Epileptic Attack.** The attack was described as follows: - The patient becomes dumb and loses consciousness, being insensible to sound, sight and pain. His body is drawn up and twisted from all sides; in particular, his hands are cramped, his teeth clenched; he kicks with his legs and shows distortion of the eyes; foam flows from his mouth; he suffocates and may pass excrements.

Following the fall to the ground, Aretaeus distinguished three main periods - firstly, "manifestation" characterized by insensibility, and tonic and clonic convulsions; secondly, "abatement" with an unconscious discharge of urine, feces or semen; and finally the phase of "cessation."

Besides stridor moaning and the uttering of confused sounds, the initial cry was also observed. Special attention was paid to the convulsive movements in the region of the face. The victim's pulse was described as being irregular during the whole course of the attack. It was "strong, and quick, and small in the beginning - great, slow and feeble in the end."

Pathological Theories

In the Hippocratic period, the human brain was visualized as being divided in half by a delicate membrane. From the entire body many fine vessels ran to the brain. These vessels were thought to be the breathing organs of the brain, drawing air in, spreading it via the small vessels over the whole organism, cooling the organism, and finally letting the breath out again. Theoretically, excess phlegm from the brain could be routed to the lung, heart or abdomen, causing asthma, palpitations or diarrhoea. But if these roads were blocked, the cold phlegm obstructed the cerebral vessels, cooled the blood, decreased the rate of flow and thus caused the symptoms of the epileptic attack.

It is most profitable to turn to the teachings of Galen during the 1st century A.D. Galen felt that if convulsions occurred in an isolated part of the body, the cause must lie in an injury of the corresponding nerve. But since psychic functions were also impaired, the disease must originate in the brain. He further contended that since the epileptic attack lasted only a short while and quickly ceased, it could not result from a permanent change in brain substance. Rather, an obstructive component must be present which could be removed. This obstruction, he felt, consisted of an agglomeration of a thick humor in the middle or posterior ventricle of the brain. In order to overcome this obstruction, the roots of the nerves must shake themselves, thus initiating the convulsions of the body.

Galen was very emphatic about his contention that all epileptic attacks are due to affections of the brain. However, he shrewdly proposed that the brain could be affected either primarily and directly, or indirectly from another part of the organism. In the first case, epilepsy is the outcome of an "idiopathic" or "protopathic" affliction of the brain; this type being most common and appearing in childhood. In the limited number of remaining cases, Galen proposed that the original lesion was located in the heart or elsewhere with the epileptic attacks resulting from a "sympathetic" affliction of the brain. The term "sympathetic" did not imply anything mysterious; it simply meant that the brain had also become involved.

Altogether, then, Galen distinguished three forms of epilepsy: (1) Idiopathic epilepsy (2) Epilepsy due to sympathetic involvement of the brain originating from the heart. (3) Epilepsy due to a sympathetic involvement of the brain originating from any other part of the body.

Treatment

It was of great importance to treat a case of epilepsy before it had become chronic. The best chances for treatment were offered when attacks started from the hands and feet, when the patients were young, fond of work and not mentally impaired. "For it is easier", says Soranus, "to prevent what is threatening than to expel what is present." The ancient physicians were well aware of their limitations, and one should hardly be surprised that they sought assistance from peculiar remedies and enterprising magicians.

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In the 4th century, Diocles treated epileptic patients according to the underlying cause. If this was found to be in the victim's underlying constitution, he advised purging of phlegm, and in addition, diuretic remedies, walking and exercise. If however, the disease had been precipitated by drunkenness, or eating meat, he recommended phlebotomy. He also used pills, which, according to Soranus, upset the stomach and caused vomiting after meals.

Up to this point, little correlation was made between the treatment and the pathology of the disease. With Aretaeus and Galen, co-ordination between the two, becomes much more obvious.

Aretaeus distinguished between the acute epileptic paroxysm and the chronic disease. For the paroxysms, he applied venesection, ointments and provoked vomiting. In his cure of chronic epilepsy, Aretaeus used such procedures as blood letting at the elbows and forehead, cutting of arteries in front of and behind the ears, trephining and cauterization of the skull.

The dietetic treatment of epilepsy as based upon pathological considerations, finds its highest development in the writings of Galen. His chief attention was directed toward "idiopathic" epilepsy.

In the treatment of chronic epileptics, the evacuation of the phlegmatic humor was one of Galen's chief aims. This evacuation was performed either by the use of purgative medicaments, or by bleeding from the lower arm or thigh. However, Galen felt that the bleeding would only prove successful if the patient were willing to lead a very temperate life afterwards. Excesses in eating and drinking would quickly make the humor reaccumulate and thus spoil the effect of the evacuation.

The difference between the dietetic and pharmacological treatment of epilepsy corresponded to a difference in the social standards of the patients. For only men free from the necessity of earning their daily bread and rich enough to choose their food, drink and exercise could afford the luxury of a strict regimen. The poor had to stake their hope on a drug that promised a quick cure, or else upon a remedy suggested to them by a friend or a quack.

MIDDLE AGES

If one takes a broad view of the medical theories of epilepsy during the Middle Ages, to the modern reader they appear as mere

variations of the ancient theories, especially those of Galen. Cassius Felix, who wrote as late as 447 A.D. offers nothing but a recapitulation of ancient views. He distinguishes two varieties of epilepsy; one accompanied by convulsions, the other marked by sleep. The three pathological forms as distinguished by Galen and his successors were now given separate names. Epilepsy as a general term connoted the disease as such, and in a restricted sense it also signified the idiopathic form located in the head; the form originating in the stomach was designated as 'analepsy' and the form arising from other parts of the body came to be known as 'catalepsy'. It was only at the time of the Renaissance when medical terminology was purged that these names disappeared from the literature.

A new period in the history of medieval medicine was initiated by two factors: the translation into Latin of many important classical and Arabic texts, and the organization of medical studies at medical schools and universities. Thus, from the end of the 11th century on, the science of medicine entered the phase of 'scholasticism'. The scholastic physicians accepted the Galenic distinction of the three types of epilepsy and it was now the aim of scholastic pathology to give an explanation of the clinical varieties of epilepsy on the basis of the traditional theories. The Salernitan physician, Platearius, wrote of the three Galenic types as well as two clinical varieties which he distinguished as 'major' and 'minor' epilepsy. This latter is reminiscent of the modern distinction between 'grand mal' and 'petit mal' epilepsy, and Platearius's distinction is worth quoting: "Major epilepsy is a complete obstruction of the principal ventricles of the brain. People suffering from it fall down quickly. The mouth and face are distorted and there is also a trembling movement of the neck and of the whole body and clenching of the teeth. Sometimes they pass urine, faeces and seed involuntarily; they snore and froth, and, when the froth has been wiped off, they froth again. Minor epilepsy is an incomplete obstruction of the ventricles of the brain. People suffering from it sometimes fall down; sometimes they do not fall down, but faint. The froth, once having been wiped off, does not reappear and they are quickly relieved."

Ali Ibn Abbas stated that an obstruction in the brain could also be the result of compression of the brain brought about by a frac-

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ture of the skull. This statement had great merit, directing the attention of later physicians to this important relationship.

Of equal importance was the realization that epilepsy might be inherited. This view had its beginnings during antiquity, but it was much more emphasized during the Middle Ages. Among the early Arabic authors, epilepsy was considered as one of the seven diseases "which are hereditary from the parents."

To summarize, it can be said that the Middle Ages added little to the physiological understanding of epilepsy. Yet at a time when the vague conception of 'the falling evil' was prevalent, it is highly significant that the medieval physicians were able to keep alive the tradition that epilepsy was a natural disease, and not caused by supernatural powers.

RENAISSANCE

During the 16th century, observations were made and published which considerably broadened the clinical knowledge of epilepsy. Many of the observations made during the 16th and 17th centuries referred to the various factors which preceded the onset of epileptic attacks. The belief that sudden fear and excitement could cause epilepsy was very widespread and even the sight of an epileptic attack was reported to have provoked the disease in some terrified bystanders. The belief in the possible psychogenic origin of epilepsy went so far that Fabricius Haldanus attributed two cases of epilepsy in infants to the imagination of their mothers who had seen epileptics while pregnant!

Equal, if not greater, attention was paid to injuries of the head preceding the occurrence of epilepsy. It was, moreover, realized that epileptic seizures might appear many years after a head injury.

More difficult to decide was the relationship between epilepsy and syphilis. It did not escape the attention of the Renaissance physicians that many syphilitics developed epileptic convulsions; however, syphilis was not the only disease to be connected with epilepsy. Scurvy, smallpox, measles and other fevers likewise entered into this category. This realization of such possibilities led to the concept of 'symptomatic' epilepsy.

Theories on the pathology of epilepsy continued to abound. The belief that idiopathic epilepsy was caused by a humoral ob-

struction of the ventricles of the brain remained and for many years it was repeated and even defended against the modernists. However, it was the medieval hypothesis of poisonous vapors affecting the brain, as was elaborated by Fernelius, that was most widely accepted by Renaissance physicians. Fernelius had supported his arguments by dissecting the brains of two epileptics and in both cases the ventricles as well as the ducts of the brain were free from any humor or any obstruction. The anatomical observations of Fernelius were soon supplemented by other writers.

These observations confirmed the opinion that epilepsy must be due to an irritation of the brain by some poisonous substance. The idea of an irritation as the fundamental cause remained in the foreground after the beginning of the 17th century. Above all, it accounted for epileptic attacks following wounds, syphilis, ulcerations of the cerebral membranes and intracranial bleeding. Usually, however, an ascending vapor was held responsible for the irritation of the brain. From now on, most authors recognized only two types of epilepsy: idiopathic epilepsy originating in the brain itself, and sympathetic epilepsy arising from some other organ. The three Galenic types were now definitely put aside.

THE GREAT SYSTEMS AND THE PERIOD OF ENLIGHTENMENT

The latter part of the 17th century witnessed the development of some theories of epilepsy which took into account the new discoveries in the fields of chemistry and physics.

Sylvius (1614-1672) placed the cause of epilepsy in the animal spirits themselves, which he felt were necessary for the functioning of both movement and sense perceptions. If the animal spirits became ill-disposed, movement and sense perceptions would be affected. The precipitating agent was thought to be an acid volatile spirit, and from this chemical explanation, Sylvius deduced the principle of his chemical therapy - a basic salt to neutralize the acid spirit!

For Willis (1622-75) ordinary muscular motion was brought about by an explosion. This explosion was caused by the ignition of spirituosaline particles in the muscle fibres and nitrosulphurous particles found in the arterial blood. He proposed the following hypothesis: The animal spirits found in the middle of the brain were mixed with a strong

explosive medium distilled from the arterial blood; the subsequent explosion would then cause all the mental symptoms of the epileptic attack and a series of similar explosions occurring along the rest of the nervous system would bring about the convulsions of the body.

We now enter the era of Enlightenment. The majority of physicians during the second half of the 17th century and a great number of them in the first half of the 18th century did not exclude the infliction of epilepsy by the Devil and by witches. Willis was not the only mechanist who shared such beliefs. For Bartholinus, the chief medical interpreter of biblical diseases in the latter half of the 17th century, the demoniac nature of epilepsy was undoubted. It was a paradoxical result that the enlightened century revived an idea in the demoniac etiology of epilepsy. And in its new form, this idea had grave consequences, for it lasted far into the 19th century and gave a strong impetus to the demand for isolation of epileptics.

Influence of the moon upon epilepsy was taken as an established fact until the end of the 17th century. The physical influence of the celestial bodies upon the earth had been confirmed by Newtonian physics, especially by the law of gravitation and the lunar explanation of the tides. Even the more enlightened physicians, like Richard Mead, now saw a possibility for satisfactory explanation. He gave various examples of epileptic attacks occurring regularly at certain constellations of the moon. The moon, he thought, exerted its power above all upon the animal spirits, these being the thinnest and most elastic parts of the body. It was probably due to the authority of Mead's name that belief in the influence of the moon survived so long in British medicine, even among men like John Hunter.

It is ironic that the renunciation of old beliefs usually leads to the creation of new ones and superstitions are often exchanged rather than abandoned. This can be said for epilepsy, for it was now claimed that the disease could be caused by masturbation and here Tissot assumed the leading role. For more than a century and a half masturbation figured as one of the main causes of epilepsy in medical literature. The superstition reached its climax when castration was proposed. Writing in 1881, Gowers, the leading English neurologist, states that castration has proved

unsuccessful as a therapy for epilepsy. Then he adds: "Castration has been lately revived by Bacon as a means of arresting epilepsy due to masturbation in adult insane patients." But even Gowers believed in masturbation as a causal factor and advocated surgical measures. "In boys, however, circumcision, if effectually performed, is usually successful and should be adopted in all cases in which there is reason to associate the disease with masturbation."

NINETEENTH CENTURY

First Period - 1800-1833: This period was most marked by the humanization of the treatment of the insane; their former prisons began to assume the character of hospitals. This change benefited epileptics too, for in most countries confinement of epileptics in separate wards of lunatic asylums became the established practice around 1850. Then once segregation was achieved, the next step was for separate institutions for epileptics and the National Hospital for the Paralyzed and Epileptic, Queen Square, London was founded in 1859.

A great deal of the terminology used today was first heard in the French hospitals in the early 1800's. In 1815, Esquirol stated that "sometimes the attacks alternate in intensity: there are severe and slight attacks; this is what is called *le grand* and *le petit mal* in the hospitals." These terms were loosely defined, but proved adequate - 'grand mal' being associated with the fully developed fit and 'petit mal' being a convenient term for those cases characterized by attacks that did not fully develop. Another term that became familiar in the hospitals was 'status epilepticus.'

Since many of the physicians of this period were psychiatrists, the psychic abnormalities of the epileptics met with special interest. Esquirol and his pupils stressed the close connection between epilepsy and insanity. Among the various psychiatric complications mentioned by Esquirol, none were studied so carefully and assumed such far reaching importance as the maniacal attacks from which epileptics were prone to suffer. This 'furor epilepticus' was observed preceding the fits, following them, and most significantly, it was noted that it might take place independently of any classic fit. Along with the description of epileptic mania, other types of mental confusion were described - epileptic

somnambulism and epileptic ecstasy. The recognition of maniacal states as epileptic manifestations had more than academic interest. The 'furor epilepticus' was dangerous; patients in this condition could conceivably commit murder, and the correct interpretation of such a state was therefore of great legal importance.

Second Period 1833-1861. In a memoir published in 1832, Flourens laid down some basic rules concerning irritability and sensibility of the central nervous system. He felt that the nervous system was not homogeneous; different functions could be assigned to different parts. In particular he proposed that the cerebral hemisphere and the cerebellum were not irritable: irritability pertained to the spinal cord, the medulla oblongata and the corpora quadrigemina, and these parts alone had the property of immediately exciting muscular contractions. The cerebral hemispheres were thought to be the exclusive seat of volition and sensation and co-ordination of movement was assigned to the cerebellum. But the epileptic attack did not manifest itself by convulsions alone; it also implied loss of voluntary movements and loss of consciousness. The cerebrum thus had to be implicated and the question as to how different parts of the brain could be affected so as to account for the different symptoms of the epileptic fit became more crucial than ever.

HUGHLINGS JACKSON AND THE END OF THE 'FALLING SICKNESS'

In 1859, John Hughlings Jackson came to London at a crucial point in his life. He intended to give up his medical career and devote his efforts to philosophy, but Sir Jonathan Hutchinson persuaded him to remain in the field of medicine.

Jackson's first publication on epilepsy concerns **Cases of Epilepsy Associated with Syphilis**. This work was indicative of his entire later work, for it related to unilateral epilepsy. "In most of the following cases," Jackson writes, "the convulsions were limited to one side, and in one of them the epileptic fit was not complete, there being no loss of consciousness." More than any other contemporary author, Jackson brought cases of unilateral epileptic convulsions to the attention of his colleagues. In 1863, Jackson came to a definite conclusion regarding the morbid anatomy of unilateral convulsions. "In very

many cases of epilepsy, and especially in syphilitic epilepsy, the convulsions are limited to one side of the body; and, as autopsies of patients who have died after syphilitic epilepsy have shown the cause is obvious organic disease on the side of the brain, opposite to the side of the body convulsed, frequently on the surface of the hemisphere."

The year 1864 was very important for at this juncture Jackson published his first major article on aphasia. Three years previously, Broca had studied the case of an epileptic suffering from motor aphasia and localized the seat of the speech defect in the third frontal convolution of the brain. Jackson proposed that unilateral convulsions associated with speech defects were caused by pathological lesions involving the middle cerebral artery. The left middle cerebral artery supplies the roots of the olfactory bulb, the corpus striatum and the cerebral hemispheres, and from this one could readily understand how such seemingly unrelated phenomena as an aura of a disagreeable smell, unilateral convulsions and aphasia might be related to either an embolus or vasospasm of that middle cerebral artery. Jackson's conviction that the corpus striatum was the area of the brain affected in convulsions strengthened in the following years, even though Wilks in 1866 proposed that motor fibres might run directly from the cerebral cortex, thus implying that the cortex might be the seat of convulsions.

Jackson's analysis of unilateral epilepsy demonstrated that a certain order existed in the onset and spread of the convulsions. Most frequently the attacks started in the arms with the thumb and forefinger being affected first. At sometime between 1868 and 1870, it occurred to him that instability of the gray matter of the cerebral cortex might account for the convulsions. In 1870 he wrote, *Palsy depends on destruction of fibres and convulsion on instability of gray matter. As the convolutions are rich in gray matter I suppose them to be to blame, in severe convulsions at all events; but as the corpus striatum also contains much gray matter, I cannot deny that it may sometimes be the part to blame in slighter convulsions.*

In 1870, Fritsch and Hitzig, published their investigations **On the Electric Excitability of the Cerebrum**. They discovered the motor area of the cerebral hemisphere in dogs, demonstrating that localized groups of musc-

les could be irritated by the application of weak electric currents upon a very small region of the hemisphere and that application of stronger currents or prolonged application would precipitate convulsions. These convulsions might begin locally and then develop into well characterized epileptic attacks! Here, indeed was experimental proof for Jackson's clinical observations and pathological ideas. Anatomical studies of the conductive fibres gave a sound basis for Jackson's contention that localized convulsions indicated localized injuries of the cerebral convolutions and that the convulsions might spread, if the discharge was propagated and involved more and more nervous tissue.

Jackson felt that unilateral convulsions represented the simplest form of epileptic attacks and it was from this point that the study of epilepsy had to proceed. This meant a radical break with the usual concept of epilepsy and he proposed the following broad definition, "Epilepsy is the name for occasional, sudden, excessive, rapid and local discharges of gray matter." According to this definition there was no one disease called epilepsy but many epilepsies. Even "a sneeze is a sort of healthy epilepsy," said Jackson. Migraine headache also belonged in this group.

Jackson's task now was to explain the different forms of epilepsy anatomically and physiologically. He suggested that in those cases where there was sudden and temporary loss of consciousness with either absent or minimal convulsive movements, the disorder was chiefly in the area supplied by the anterior cerebral artery. This was an early explanation of what would be called petit mal epilepsy. After 1870, he wrote more frequently and more extensively on other than unilateral epilepsy. In genuine epilepsy where consciousness was lost at the onset of the attack, the stimuli were thought to begin in the very highest nervous centres of the cerebral hemisphere; unilateral epilepsy was not essentially different except for the fact that here the discharge began in the cerebral area representing muscular movements.

Still to be considered is the place of hysterical fits. Were they to be considered as epileptic and to be explained on the same basis as epileptic seizures? Or were they to be distinguished from epilepsy? It is difficult to obtain a clear picture of Jackson's views on hysteria and we must turn to Charcot (1825-93) for clarification. It seemed a logical necessity to distinguish sharply between diseases of the nervous system and diseases of the mind. Charcot's theory of hysteria was the logical counterpart of Jackson's theory of epilepsy. Charcot distinguished between the two diseases and considered hysteria a common denominator of all those convulsive disorders which in the past had been connected with divine ecstasies and demoniac possession. Charcot related hysterical convulsions to passion and the emotions, thus providing the groundwork for its modern day classification as a form of neurosis.

Since Jackson and Charcot our knowledge of epilepsy has increased in many details. With the modern advances in neurological diagnosis, cases which previously remained unexplained, have revealed their 'symptomatic' nature. The electroencephalogram has allowed us to probe the electrical activity of the brain; brain surgery has become more advanced and sometimes it is possible to remove the epileptic focus, new drugs have been discovered. This boom in medical knowledge continues to increase, and in spite of this, the final explanation of epilepsy is still to come.

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