



## JACKSONIAN SEIZURE

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### ABSTRACT

Central pain of epileptic etiology is very rare. The frequency of painful sensations in epileptic seizures varies between 0.3 and 2.8%. We report a patient with short-lasting painful attacks in the right arm. Changes in the electroencephalography (EEG) and the effective treatment with anticonvulsants in contrast to the therapeutic failure of analgesics, lead to the diagnosis of partial epilepsy with painful seizures. Magnetic resonance imaging (MRI) of the brain was normal, whereas a postcentral parietal site of seizure origin involving the secondary somatosensory area was suggested by electroencephalographic findings. The literature is reviewed for cases with pain as the sole or predominant symptom of epileptic seizures. Jacksonian seizures were analyzed in 42 patients with regard to anatomical and temporal sequences. The origin of sensory Jacksonian seizures, in contrast to motor Jacksonian seizures, often began at peripheral sites with little cortical representation. The progression of seizure activity across the cerebral cortex followed a course that was neither rectilinear, radiate, nor random; it appeared to proceed in an organized manner to involve functionally coherent units. The patterns analyzed conformed more closely to cortical somatosensory maps reported for the chimpanzee than the sensory sequences presently available for the cortex of man. Complete diagnostic studies are indicated in patients presenting with sensory Jacksonian seizures because of the frequency of related focal pathology.

**KEYWORDS:** Jacksonian, Seizure, March, Epilepsy.

### INTRODUCTION

Jacksonian march or Jacksonian seizure is a phenomenon where a simple focal seizure spreads from the distal part of the limb toward the ipsilateral face (on same side of body). They involve a progression of the location of the seizure in the brain, which leads to a "march" of the motor presentation of symptoms.<sup>[8]</sup> Jacksonian seizures are initiated with abnormal electrical activity within the primary motor cortex. They are unique in that they travel through the primary motor cortex in succession, affecting the corresponding muscles, often beginning with the fingers. This is felt as a tingling sensation, or a feeling of waves through the fingers when touched together. It then affects the hand and moves on to more proximal areas on the same side of body. Symptoms often associated with a Jacksonian seizure are sudden head and eye movements, tingling, numbness, smacking of the lips, and sudden muscle contractions. Most of the time any one of these actions can be seen as normal movements, without being associated with the seizure occurring. They occur at no particular moment and last only briefly. They may result into secondary generalized seizure involving both hemispheres. They can also start at the feet, same tingling (pins and needles), there is cramping of the foot muscles which, due to the signals

from the brain, causes great pain. Because it is a partial seizure, the postictal state is of normal consciousness.

**Partial Seizure:** Focal seizures (also called partial seizures<sup>[1]</sup> and localized seizures) are seizures which affect initially only one hemisphere of the brain.<sup>[2,3]</sup> The brain is divided into two hemispheres, each consisting of four lobes – the frontal, temporal, parietal and occipital lobes. In partial seizures the seizure is generated in and affects just one part of the brain – the whole hemisphere or part of a lobe. Symptoms will vary according to where the seizure occurs. In the frontal lobe symptoms may include a wave-like sensation in the head; in the temporal lobe, a feeling of *déjà vu*; in the parietal lobe, a numbness or tingling; and in the occipital lobe, visual disturbance or hallucination.<sup>[4]</sup>

Partial seizures are split into two main categories; simple partial seizures and complex partial seizures. A new classification system for partial seizures has been described in the 18th Edition of Harrison's Principles of Internal Medicine (released July 2011). The new classification splits partial seizures into "partial seizures with dyscognitive features" and "partial seizures without dyscognitive features".

**Simple Focal Seizure:** Simple partial seizures are seizures which affect only a small region of the brain, often the temporal lobes or hippocampi. People who have simple partial seizures retain consciousness.<sup>[5]</sup> Simple partial seizures are often precursors to larger seizures, where the abnormal electrical activity spreads to a larger area of (or all of) the brain, usually resulting in a complex partial seizure or a tonic-clonic seizure.<sup>[6]</sup> In this case they are often known as an aura.

Simple partial seizures are a very subjective experience, and the symptoms of a simple partial seizure vary greatly between people. This is due to the varying locations of the brain the seizures originate in e.g.: Rolandic. A simple partial seizure may go unnoticed by others or shrugged off by the sufferer as merely a "funny turn". Simple partial seizures usually start suddenly and are very brief, typically lasting 60 to 120 seconds.<sup>[7]</sup>

When the seizure occurs during sleep, the person will often become semi-conscious and act out a dream while engaging with the environment as normal, and objects and people usually appear normal or only slightly distorted, being able to communicate with them on an otherwise normal level. However, since the person is acting in a dream-like state, they will assimilate any hallucinations or delusions into their communication, often speaking to a hallucinatory person or speaking of events or thoughts normally pertaining to a dream or other hallucination.

### Complex Partial Seizure

A complex partial seizure is an epileptic seizure that is associated with unilateral cerebral hemisphere involvement and causes impairment of awareness or responsiveness, i.e. alteration of consciousness.<sup>[10]</sup> Complex partial seizures are often preceded by a seizure aura.<sup>[11]</sup> The seizure aura is a simple partial seizure.<sup>[11]</sup> The aura may manifest itself as a feeling of déjà vu, jamais vu, fear, euphoria or depersonalization.<sup>[12]</sup> The seizure aura might also occur as a visual disturbance, such as tunnel vision or a change in the size of objects (macropsia or micropsia).<sup>[13]</sup> Once consciousness is impaired, the person may display automatisms such as lip smacking, chewing or swallowing.<sup>[12]</sup> There may also be loss of memory (amnesia) surrounding the seizure event.<sup>[11]</sup> The person may still be able to perform routine tasks such as walking, although such movements are not purposeful or planned. Witnesses may not recognize that anything is wrong.

Complex partial seizures might arise from any lobe of the brain.<sup>[11]</sup> Complex partial seizures most commonly arise from the mesial temporal lobe, particularly the amygdala, hippocampus, and neocortical regions.<sup>[14]</sup> A common associated brain abnormality is mesial temporal sclerosis.<sup>[12]</sup> Mesial temporal sclerosis is a specific pattern of hippocampal neuronal loss accompanied by hippocampal gliosis and atrophy.<sup>[15]</sup> Complex partial

seizures occur when excessive and synchronous electrical brain activity causes impaired awareness and responsiveness.<sup>[16]</sup> The abnormal electrical activity might spread to the rest of the brain and cause a secondary generalized tonic-clonic seizure.<sup>[17]</sup>

**Epilepsy:** Epilepsy (from the Ancient Greek verb ἐπιλαμβάνειν meaning "to seize, possess, or afflict")<sup>[1]</sup> is a group of long-term neurological disorders characterized by epileptic seizures.<sup>[2]</sup> These seizures are episodes that can vary from brief and nearly undetectable to long periods of vigorous shaking.<sup>[3]</sup> In epilepsy, seizures tend to recur, and have no immediate underlying cause<sup>[2]</sup> while seizures that occur due to a specific cause are not deemed to represent epilepsy.<sup>[4]</sup>

**Signs and Symptoms:** Epilepsy is characterized by a long-term risk of recurrent seizures.<sup>[14]</sup> These seizures may present in several ways depending on the part of the brain involved and the person's age.

**Seizure:** The most common type (60%) of seizures are convulsive.<sup>[15]</sup> Of these, two-thirds begin as focal seizures (which may then become generalized) while one-third begin as generalized seizures.<sup>[15]</sup> The remaining 40% of seizures are non-convulsive. An example of this type is the absence seizure, which presents as a decreased level of consciousness and usually lasts about 10 seconds.

**Postictal:** After the active portion of a seizure, there is typically a period of confusion referred to as the postictal period before a normal level of consciousness returns.<sup>[18]</sup> This usually lasts 3 to 15 minutes<sup>[9]</sup> but may last for hours.<sup>[19]</sup> Other common symptoms include feeling tired, headache, difficulty speaking, and abnormal behavior.<sup>[19]</sup> Psychosis after a seizure is relatively common, occurring in 6–10% of people.<sup>[9]</sup> Often people do not remember what happened during this time.<sup>[19]</sup> Localized weakness, known as Todd's paralysis, may also occur after a focal seizure. When it occurs it typically lasts for seconds to minutes but may rarely last for a day or two.

### Psychosocial

Epilepsy can have adverse effects on social and psychological well-being.<sup>[15]</sup> These effects may include social isolation, stigmatization, or disability.<sup>[15]</sup> They may result in lower educational achievement and worse employment outcomes.<sup>[15]</sup> Learning difficulties are common in those with the condition, and especially among children with epilepsy.<sup>[15]</sup> The stigma of epilepsy can also affect the families of those with the disease.<sup>[3]</sup>

Certain disorders occur more often in people with epilepsy, depending partly on the epilepsy syndrome present. These include depression, anxiety disorders, and migraines.<sup>[19]</sup> Attention-deficit hyperactivity disorder affects three to five times more children with epilepsy than children in the general population. ADHD and

epilepsy have significant consequences on a child's behavioral, learning, and social development. Epilepsy is also more common in those with autism.

**Causes:** Epilepsy is not a single disease but a symptom that can result from a number of different disorders.<sup>[15]</sup> By definition the seizures occur spontaneously and without an immediate cause such as acute illness.<sup>[6]</sup> The underlying cause of epilepsy may be identified as genetic or as due to structural or metabolic problems, but in 60%<sup>[3][15]</sup> of cases the cause is unknown.<sup>[20]</sup> Genetic, congenital, and developmental conditions are more common among younger people, while brain tumors and strokes are more likely in older people.<sup>[15]</sup> Seizures may also occur as a consequence of other health problems,<sup>[20]</sup> if they occur right around a specific cause, such as a stroke, head injury, toxic ingestion or metabolic problem, they are known as acute symptomatic seizures and are in the broader classification of seizure-related disorders rather than epilepsy itself.<sup>[6,20]</sup> Many of the causes of acute symptomatic seizures can also lead to latter seizures in which case it is known as secondary epilepsy.<sup>[3]</sup>

**Genetics:** Genetics is believed to be involved in the majority of cases, either directly or indirectly.<sup>[13]</sup> Some epilepsies are due to a single gene defect (1–2%); most are due to the interaction of multiple genes and environmental factors.<sup>[13]</sup> Each of the single gene defects is rare, with more than 200 in all described.<sup>[9]</sup> Some of the genes involved affect ion channels, enzymes, GABA, and G protein-coupled receptors.<sup>[6]</sup>

In identical twins, if one is affected there is a 50–60% chance that the other will also be affected.<sup>[13]</sup> In non-identical twins the risk is 15%.<sup>[13]</sup> These risks are greater in those with generalized than focal seizures.<sup>[13]</sup> If both twins are affected, most of the time they have the same epileptic syndrome (70–90%).<sup>[13]</sup> Other close relatives of a person with epilepsy have a risk five times that of the general population.<sup>[10]</sup> Between 1 and 10% of those with Down syndrome and 90% of those with Angelman syndrome have epilepsy.<sup>[10]</sup>

**Secondary:** Epilepsy may occur as a result of a number of other conditions including tumors, strokes, head trauma, previous infections of the central nervous system, genetic abnormalities, and as a result of brain damage around the time of birth.<sup>[3][20]</sup> Of those with brain tumors, almost 30% have epilepsy, making them the cause of about 4% of cases.<sup>[10]</sup> The risk is greatest for tumors in the temporal lobe and those that grow slowly.<sup>[10]</sup> Other mass lesions such as cerebral cavernous malformations and arteriovenous malformations have risks as high as 40–60%.<sup>[10]</sup> Of those who have had a stroke, 2–4% develop epilepsy.<sup>[10]</sup> In the United Kingdom strokes account for 15% of cases<sup>[15]</sup> and it is believed to be the cause in 30% of the elderly.<sup>[10]</sup> Between 6 and 20% of epilepsy is believed to be due to head trauma.<sup>[10]</sup> Mild brain injury increases the risk about two-

fold while severe brain injury increases the risk seven-fold.<sup>[10]</sup> In those who have experienced a high powered gunshot wound to the head, the risk is about 50%.<sup>[10]</sup>

The risk of epilepsy following meningitis is less than 10%; that disease more commonly causes seizures during the infection itself.<sup>[10]</sup> In herpes simplex encephalitis the risk of a seizure is around 50%<sup>[10]</sup> with a high risk of epilepsy following (up to 25%).<sup>[20][9]</sup> Infection with the pork tapeworm, which can result in neurocysticercosis, is the cause of up to half of epilepsy cases in areas of the world where the parasite is common.<sup>[10]</sup> Epilepsy may also occur after other brain infections such as cerebral malaria, toxoplasmosis, and toxocariasis.<sup>[10]</sup> Chronic alcohol use increases the risk of epilepsy: those who drink six units of alcohol per day have a two and a half fold increase in risk.<sup>[10]</sup> Other risks include Alzheimer's disease, multiple sclerosis, tuberous sclerosis, and autoimmune encephalitis.<sup>[10]</sup> Getting vaccinated does not increase the risk of epilepsy.<sup>[10]</sup> Malnutrition is a risk factor seen mostly in the developing world, although it is unclear however if it is a direct cause or an association.<sup>[10]</sup>

**Symptoms:** Symptoms of seizures vary widely, depending on the part of the brain affected by the electrical misfiring. If a very small part of the brain is affected, you might sense only an odd smell or taste. In other cases, you could have hallucinations or convulsions, or you could lose consciousness.

**Generalized tonic-clonic.** This type of seizure is sometimes preceded by an aura (awareness of a strange odor, taste, or vision). You might lose consciousness, fall, and experience muscle rigidity (stiffness) or convulsions (jerking movements of the arms and legs). You may also lose bladder control or bite your tongue. After regaining consciousness, you might feel confused and fall asleep. **Generalized absence.** This involves loss of consciousness and blank stares or eyelid fluttering for 10 to 30 seconds. You feel well enough to resume activity right after the seizure. **Simple partial.** Although you don't lose consciousness, you have involuntary movements, sensations, or psychic experiences such as awareness of a smell or a sense of déjà vu lasting several seconds. **Complex partial.** Initial disorientation is followed by strange movements of the arms or legs or odd vocalizations for one to three minutes, as well as loss of consciousness. **Jacksonian.** Muscle twitching begins in a single area and then progresses, for example, from the hand to the arm. **Febrile.** Preceded by fever in children younger than 5, these seizures can be very brief tonic-clonic type seizures or partial seizures lasting more than 15 minutes. Most children who have a fever-induced seizure never experience a second seizure. **Infantile spasms (West Syndrome).** Lasting just a few seconds, bending of limbs, neck, and torso while lying down may occur often during a single day. This usually only strikes children younger than 3, often those with developmental delays or disabilities.

**Prevention:** While many cases are not preventable, efforts to reduce head injuries, provide good care around the time of birth, and reduce environmental parasites such as the pork tapeworm may be effective.<sup>[3]</sup> Efforts in one part of Central America to decrease rates of pork tapeworm resulted in a 50% decrease in new cases of epilepsy.<sup>[10]</sup>

**Medication:** The mainstay treatment of epilepsy is anticonvulsant medications, possibly for the person's entire life.<sup>[15]</sup> The choice of anticonvulsant is based on seizure type, epilepsy syndrome, other medications used, other health problems, and the person's age and lifestyle.<sup>[12]</sup> A single medication is recommended initially,<sup>[14]</sup> if this is not effective, switching to a single other medication is recommended.<sup>[7]</sup> Two medications at once is only recommended if a single medication does not work.<sup>[7]</sup> In about half, the first agent is effective; a second single agent helps in about 13% and a third or two agents at the same time may help an additional 4%.<sup>[8]</sup> About 30% of people continue to have seizures despite anticonvulsant treatment.<sup>[5]</sup>

There are a number of medications available. Phenytoin, carbamazepine and valproate appear to be equally effective in both focal and generalized seizures. Controlled release carbamazepine appears to work as well as immediate release carbamazepine, and may have fewer side effects.<sup>[66]</sup> In the United Kingdom, carbamazepine or lamotrigine are recommended as first-line treatment for focal seizures, with levetiracetam and valproate as second-line due to issues of cost and side effects.<sup>[7]</sup> Valproate is recommended first-line for generalized seizures with lamotrigine being second-line.<sup>[7]</sup> In those with absence seizures, ethosuximide or valproate are recommended; valproate is particularly effective in myoclonic seizures and tonic or atonic seizures.<sup>[7]</sup> If seizures are well-controlled on a particular treatment, it is not usually necessary to routinely check the medication levels in the blood.<sup>[7]</sup> Slowly stopping medications may be reasonable in some people who do not have a seizure for two to four years; however, around a third of people have a recurrence, most often during the first six months. Stopping is possible in about 70% of children and 60% of adults.<sup>[3]</sup>

**Syndromes:** There are a number of epilepsy syndromes which are typically grouped by age of onset into neonatal period, childhood, adulthood, and those with no strong age relationship.<sup>[20]</sup> Additionally there are groups with specific constellations of symptoms, those due to specific metabolic or structural causes, and those of unknown cause.<sup>[20]</sup> The ability to classify a case of epilepsy into a specific syndrome occurs more often with children.<sup>[14]</sup> Some types include benign rolandic epilepsy (2.8 per 100,000), childhood absence epilepsy (0.8 per 100,000) and juvenile myoclonic epilepsy (0.7 per 100,000).<sup>[20]</sup> Febrile seizures and benign neonatal seizures are not forms of epilepsy.

**Diagnosis:** The diagnosis of epilepsy is typically made based on the description of the seizure and surrounding events.<sup>[15]</sup> An electroencephalogram and neuroimaging are also usually part of the workup.<sup>[15]</sup> While figuring out a specific epileptic syndrome is often attempted, it is not always possible.<sup>[15]</sup> Video and EEG monitoring may be useful in difficult cases.

## CONCLUSION

During hypercapnia peak mean velocities slightly decreased in five MCAs (steal phenomenon) and remained unchanged in one MCA opposite the abnormal movements, whereas the other MCAs showed normal reactivities. The delineation of an exhausted cerebral vasoreactivity in all hemispheres opposite the involuntary limb movements suggests that haemodynamic failure is the cause of transient ischaemic attacks with limb shaking. The oldest medical records show that epilepsy has been affecting people since the beginning of recorded history. Throughout ancient history, the disorder was thought to be a spiritual condition. The world's oldest description of an epileptic seizure comes from a text in Akkadian (a language used in ancient Mesopotamia) and was written around 2000 BCE.<sup>[1]</sup> The person described in the text was diagnosed as being under the influence of a Moon god, and underwent an exorcism.<sup>[1]</sup> Epileptic seizures are listed in the Code of Hammurabi (c. 1790 BCE) as reason for which a purchased slave may be returned for a refund,<sup>[1]</sup> and the Edwin Smith Papyrus (c. 1700 BCE) describes cases of individuals with epileptic convulsions.<sup>[1]</sup>

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