DEFINITION

1. A **seizure** is an event due to abnormal, excessive discharges from central nervous system neurones. The meaning of the term seizure needs to be carefully distinguished from that of epilepsy. Not all seizures are epileptic in nature; they may be the result of arterial disease or oxygen lack, or they may be psychogenic.

2. **Epilepsy** is a disorder of brain function characterised by recurrent seizures due to a chronic underlying pathological process. Epilepsy refers to a clinical phenomenon rather than a single disease entity, and a person who has suffered a single seizure does not necessarily have epilepsy.

3. The overall incidence of **Epilepsy** in the community is about 0.5%, whereas it is estimated that 5-10% of the population will have at least one seizure during their lifetime. Epilepsy is commonest in childhood and late adult life.

CLASSIFICATION

4. In 1981 the International League against Epilepsy published a modified version of the International Classification on Epileptic Seizures, and this has been adopted by the World Health Organisation (WHO).

Types of seizure.

5. The WHO classification recognises 3 main categories of seizure, and further subtypes within these categories. It is based on the clinical features and associated electroencephalographic (EEG) findings.

    5.1. Generalised seizures

        5.1.1. absence seizures

            5.1.1.1. typical

            5.1.1.2. atypical

        5.1.2. Myoclonic

        5.1.3. Tonic-clonic

        5.1.4. Tonic

        5.1.5. Atonic

    5.2. Partial seizures

        5.2.1. Simple with no impairment of consciousness

5.2.2. Complex where consciousness is impaired

5.2.3 Partial seizures of either type 5.2.1 or type 5.2.2 which go on to become generalized

5.2.4 Another type of clinical generalized seizure in which there is EEG but not clinical evidence of focal onset

Types 5.2.3 and 5.2.4 are also called secondarily generalized seizures.

5.3 Unclassified seizures.

6. Using the above classification the clinically most important seizure types are typical absence seizures (petit mal), tonic clonic generalised seizures (grand mal or generalised convulsions) and partial seizures (focal seizures) of various subtypes.

Types of Epilepsy.

7. This classification is based on the underlying cause of seizures rather than on the nature of the seizures themselves. The development of investigative techniques, particularly magnetic resonance imaging, has allowed valuable insight into epilepsy and should enable the types of epilepsy to be more accurately classified in the future.

7.1. **Idiopathic epilepsy**, also called primary generalised epilepsy. The term idiopathic is used where there is **no apparent cause for the seizure**. In this type the seizures are generalised from the onset.

7.2. **Symptomatic epilepsy**. Here, the seizure activity is **focal** and remains so, or it starts as a focal seizure and becomes generalised. Partial seizures always arise from some focal area of structural abnormality in the brain, as for example in the lesion called mesial temporal sclerosis.

7.3. **Cryptogenic epilepsy**. This term covers cases where it is not possible to be certain whether tonic-clonic seizures arise on the basis of primary generalised epilepsy or whether they have arisen from a focus which is clinically silent.

CLINICAL MANIFESTATIONS

Tonic clonic seizures (grand mal seizures, generalised convulsions)

8. The hallmark of a tonic clonic seizure is disordered muscular contraction. In the first or **tonic** phase the body becomes rigid and, as normal coordinated posture is lost, the person falls to the ground. The chest muscles contract and air is forced out through the larynx in an involuntary grunt. The jaw muscles contract and the tongue may be bitten. Cyanosis results from the high oxygen consumption of the vigorously contracting muscles, and apnoea. Disordered swallowing causes dribbling of saliva and disordered sphincter muscle activity leads to incontinence.

9. The tonic phase may last seconds or minutes and is followed by the **clonic** phase, where there is rhythmic muscle contraction of limbs and trunk. The person goes into a stupor followed by gradual recovery, through confusion, to full consciousness. Following this there is usually headache, and a general feeling of exhaustion probably due to the vigorous muscular contractions. There may be post-fit confusion.

Absence seizures (petit mal)

10. This is a disorder with onset in childhood. Attacks continuing into adult life are rare. A typical attack is very brief, lasting only seconds. The child stops what he is doing, stares, and may momentarily flutter his eyelids. The attack stops abruptly and may be undetected. A diagnosis of absence seizures is made where an EEG record show a characteristic 3Hz spike and wave activity. About a third of children with petit mal go on to develop tonic clonic convulsions.

Partial seizures (focal seizures)

11. Partial or focal seizures result from a neuronal discharge localised to one part of the brain, with the clinical features dependent on the site of origin. An attack may start as a partial seizure and go on to become generalised.

12. Partial seizures arising in the motor cortex (Jacksonian seizures) produce muscle contraction in the opposite side of the body. Seizure activity begins at the angle of the mouth, the index finger and thumb or the big toe. This is because the cortical representation of these body parts is large and the excitatory threshold of these cortical cells low.

13. Another type of motor seizure with its origin in the posterior frontal or temporal lobe is the **versive seizure**, where the eyes are deviated away from the hemisphere of seizure origin.

14. More common than focal motor seizures are **temporal lobe seizures** (complex partial seizures or partial seizures with autonomic, psychic or special sensory symptoms). There may be stereotyped motor behaviour involving the lower part of the face, for example grimacing, lip smacking and sucking. Olfactory and visual hallucinations may occur in temporal lobe seizures.

Status epilepticus

15. This is a medical emergency in which seizures follow each other without remission. During this time the patient is at risk of cardio-respiratory failure. It is usually seen in relation to tonic-clonic seizures. If it occurs in relation to absence or temporal lobe epilepsy the presentation is of a confusional state of indeterminate origin.

AETIOLOGY

16. Both genetic and external factors have been implicated as causes of recurrent seizure activity.

Genetic factors

17. Extensive studies in man over the past 50 years have established a likely genetic contribution to the aetiology of epilepsy in all cases. However the pattern of inheritance in otherwise normal individuals has not been identified precisely.

18. Seizures may occur in individuals with other evidence of grave cerebral dysfunction, for example the recessively inherited disorder Tay-Sachs disease, and dominantly inherited disorders such as neurofibromatosis and tuberous sclerosis.

19. There is evidence that the absence seizures form of primary generalized epilepsy is inherited as an autosomal dominant disorder. 40% of siblings of children with absence seizures (petit mal) have the 3Hz spike wave pattern even in the absence of clinical symptoms and signs. A proportion of the parents of these children also show the characteristic EEG seizure discharge.

20. Twin studies show that, with identical twins, if one twin has a febrile convulsion, the risk of the other having a similar episode is 80%. In the case of non-identical twins the risk is about 25%.

21. In addition if an individual has a significant head injury, post-traumatic epilepsy is more likely to follow in those in whom there is a family history of epilepsy.

External factors

22. Some external events play a major role in the genesis of seizures.

Trauma

23. Cerebral trauma may result from birth injury or asphyxia. In these cases the cerebral damage is usually severe, with cerebral palsy or mental retardation.

24. Epilepsy is not a consequence of mild head injury, such as a bruise or abrasion on the head. However, head trauma may cause epilepsy, with the likelihood strongly correlated to the severity of the injury. Certain specific types of head injury are particularly associated with a risk of developing post-traumatic epilepsy, as discussed below:

25. **Penetrating head wounds** (for example from a rifle bullet or shrapnel) are particularly liable to give rise to epilepsy. Risk factors of significance in this form of head injury are site and extent of brain tissue damage, persisting neurological deficit, retained foreign bodies, haematoma, and infection including cerebral abscess. The overall risk of subsequent epilepsy has been put at 50%. About 70% of those who develop epilepsy will have had their first seizure within 3 years after their injury.

26. Persons who have sustained **severe blunt head injury** are also at increased risk. Associated risk factors identified in various surveys are intracranial haematoma, depressed skull fracture with dural tear, early post-incident seizures and persisting neurological deficit. The likelihood of post-traumatic epilepsy is increased if there is unconsciousness or amnesia lasting 24 hours or more after the injury. If recurrent seizures occur they almost always develop within 1 year after head trauma.

Tumours

27. Both benign and primary and secondary malignant cerebral tumours may result in epilepsy. Treatment by irradiation or resection may fail to eliminate or improve seizure activity.

Infectious diseases

28. Bacterial meningitis, cerebral abscess and viral encephalitis may cause seizures. Unusual causes of epilepsy in the UK are echinococcal cysts, cysticercosis, toxocariasis and toxoplasmosis.

Degenerative disease

29. The incidence of seizures increases with age. They may occur in Alzheimer's disease.

Vascular disease

30. Cerebral emboli may result in epilepsy. These may be seen with ischaemic heart disease or in rheumatic valvular disease. In the latter condition emboli are a potential complication of prosthesis surgery. It is though that the basis of epilepsy in these cases is anoxia. Diffuse cerebral anoxia may also follow transient cardiac arrest and thereby give rise to epilepsy.

Alcohol

31. Seizures may result from acute alcohol poisoning or may be found in chronic alcohol abuse. In chronic abuse, abstention does not eliminate seizures.

Metabolic and iatrogenic

32. Both hyperglycaemic and hypoglycaemic states may be associated with seizure activity.

33. Uraemia can cause fits, as can hypocalcaemia. Of medically prescribed drugs which may give rise to seizures the most common are phenothiazines and tricyclic antidepressants.

Stress

34. Epilepsy is **invariably** due to a physical disorder in the brain, as detailed above. Neither acute nor chronic stress is a cause of epilepsy. If a person who suffers from recurrent seizure activity is physically or mentally stressed, fit frequency may increase as part of the response to that stress. The time interval between the stress and the increased frequency of fits is short.

Precipitants of seizures

35. Distinct from the root causes of epilepsy there are other factors which may precipitate an attack in any individual who already experiences recurrent seizure activity (stress has been mentioned above). Such precipitants may be very personal. They range from alcohol, drugs, sleeplessness, intercurrent illness and worry to television epilepsy. In some patients with epilepsy seizures are virtually confined to the hours of sleep.

Course and Complications

36. In **community studies**, six years after epilepsy was first diagnosed about half the people suffering from recurrent seizure activity have been seizure-free for five years. The figures are less optimistic where the study population is hospital cases. If seizures do not remit within a few years of diagnosis subsequent remission is unlikely. Unfavourable factors are complex partial seizures mixed with tonic clonic seizures, seizure clustering, physical signs of neurological damage and mental retardation.

37. If epilepsy results from perinatal damage there may be hyperkinesis or learning problems.

38. In temporal lobe epilepsy an illness analogous to paranoid schizophrenia is recognised. These patients often have loss of libido and impotence.

39. There is no good evidence that seizure activity leads to dementia. However if status epilepticus causes cerebral anoxia there may be cerebral damage.

CONCLUSION

40. **Epilepsy** is a condition where there is a physical disorder in the brain and an ongoing tendency to seizures. The classification of the condition is complex, but with the development of widely available investigative techniques should become more accurate. Constitutional and environmental factors play a part in the aetiology.

REFERENCES

Hopkins A. Epilepsy. In: (Eds) Weatherall D J, Ledingham J G G and Warrell D A. Oxford Textbook of Medicine. Oxford. Oxford University Press. 3rd Ed. 1996. 24.4.1.

Lowenstein D H. Seizures and Epilepsy. In: Fauci A S, Brunwald E, Isselbacher K J, et al. Harrison's Principles of Internal Medicine. 14th Ed. 1998. p365.

Chadwick D. Seizures, epilepsy and other episodic disorders. In: (Ed) Walton J. Brain's Diseases of the Nervous System. 10th Ed. 1993. p22.

DSS Medical Policy. Stress Related Illness - a Report for DSS Policy Group: Part 2. February 1998.

May 1999