### The Scope and Lexicon of EPILEPSY

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### Disclosures

### Nothing to disclose





The Transfiguration Raphael Sanzio (1483 – 1520) Vatican Gallery, Rome







### Etymology

- Seizure from seisir (Old French, derived from Latin) – "to take hold of"
- First used as a military term by the Athenian historian Thucydides in recording the Peloponnesian War (431-404 BCE) as Sparta seized Athens
- Epilepsy from epilambanein (Greek) "recurrent events"





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### Ten Famous People with Epilepsy

- 1. Edgar Allen Poe (1809-1849) Bard of Baltimore
- 2. Charles Dickens (1812-1870) English author
- 3. Fyodor Dostoyevsky (1821-1881) Russian novelist
- 4. Lewis Carroll (1832-1898) English author
- 5. Vincent Van Gogh (1853-1890) Dutch painter
- 6. Theodore Roosevelt (1858-1919) 26<sup>th</sup> US President
- 7. Neil Young (1945 ) American singer/songwriter
- 8. John Roberts (1955 ) US Supreme Court Chief Justice
- 9. Prince Rogers Nelson (1958-2016) US musician
- 10. Florence Griffith Joyner (1959-1998) US Olympic sprint champion, "fastest woman on earth" (100, 200 m)









### Historical Underpinnings of Epilepsy

 But this disease seems to me to be no more divine than others; but it has its nature such as other diseases have, and a cause whence it originates, and its nature and cause are divine only just as much as all others are, and it is curable no less than the others...Its origin is hereditary, like that of other diseases.



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### On the Sacred Disease Hippocrates 400 BCE





### History of Epilepsy - Boston







### Who wrote this?

William Osler affirmed that the physician who knew syphilis in all its manifestations knew all of medicine. Today's scope for the person who would know all of epilepsy is even wider. In addition to the expanding preclinical sciences, including genetics, he would encounter problems that belong in the fields of pediatrics, endocrinology, neurosurgery, neurology, psychiatry, laboratory diagnosis, and preventive medicine. He would delve also into medical history, sociology, legal medicine, philosophy, religion, social work, and medical economics. In addition, more than most doctors, he must learn the art as well as the science of the practice of medicine.



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- William G. Lennox •
- Epilepsy and Related Disorders, William Gordon Lennox with the collaboration • of Margaret A. Lennox, Little, Brown and Co., Boston 1960, p. 31.





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### New Terminology and Beyond Seizures

- What is the new lexicon of epilepsy?
- How has the classification of seizures and epilepsy changed?
- What are the co-morbidities of epilepsy?
- What is SUDEP?





### Seizures: The "Standard" Lexicon

Seizures may be:

*Situational*: febrile, hypoglycemic, impact OR *Epileptic*:

- •Focal in onset
- Primarily generalized
- Focal with secondary generalization

Epilepsy is defined as :

recurrent unprovoked seizures





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### Magnitude of the Problem

- 3.5 million people in the US have active epilepsy.
  - 3 M adults; 470,000 children (Epilepsy Facts, Statistics, and You Healthline.Accessed Online10 July 2019)
- 150,000 new cases are diagnosed in the US annually.
- Approximately 65 million people worldwide have epilepsy.
- 1 in 24 Americans will develop epilepsy.





### More Epidemiology

- Children and older adults are the fastestgrowing segments of the population with new cases of epilepsy.
- Epilepsy is the fourth most common neurological disorder in the United States after migraine, stroke, and Alzheimer's disease.





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### **NEW Definitions for Epilepsy**

- 1. Two unprovoked seizures occurring 24 hours apart
- 2. One unprovoked seizure and a probability of further similar seizures with a recurrence risk of 60% (similar to that after 2 unprovoked seizures occurring over the next 10 years)
- 3. Epilepsy is RESOLVED for patients with age dependent epilepsy syndromes now past the applicable age or have remained seizure free ten years with no medications X five years.





### Terminology: A Changing Landscape

•The committee believes the term "epileptic" should be discontinued because it has negative connotations.

- •The committee suggests using terms such as:
- "seizure medications" (to replace "antiepileptic drugs")
- "epilepsy seizures" (to replace "epileptic seizures")





#### EPILEPSY across the SPECTRUM

The Scope and Lexicon of Epilepsy

INSTITUTE OF MEDICINE

### Other important concepts marked by changing terminology • ETIOLOGY

- Idiopathic, symptomatic, and cryptogenic have been replaced by Structural, Genetic, Infectious, Immune, Metabolic, and Unknown
- ELECTROCLINICAL SYNDROMES
  - Largely arranged by age at onset
- EPILEPTIC ENCEPHALOPATHY
  - The epileptic activity itself may contribute to the encephalopathy, beyond that from the underlying pathology, and deficits may worsen over time. May even exist without seizures.





## Changing Landscape of the Lexicon

- Person with epilepsy
- Epilepsy seizures
- Anti-seizure drugs
- Focal aware
- Focal impaired awareness
- [F/G] motor [t-c, t, c]
- Focal to bilateral t-c
- [F/G/Unknown] onset epileptic spasms
- Genetic
- Structural-metabolic
- Unknown
- Developmental and Epileptic encephalopathy



- Epileptic
- Epileptic seizures
- Anti-epileptic drugs
- Simple partial
- Complex partial
- Convulsion, GTCS
- Secondarily generalized
- Infantile spasms
- Idiopathic
- Symptomatic
- Cryptogenic
- Epileptic Encephalopathy



### Classification of Seizures ILAE 2010

- Generalized
  - Tonic-clonic (in any combination)
  - Absence
  - Myoclonic
  - Clonic
  - Tonic
  - Atonic
- Focal
- Unknown
  - Epileptic spasms



#### ILAE classification of the epilepsies: Position paper of the ILAE Commission for Classification and Terminology



Operational classification of seizure types by the International League Against Epilepsy: Position Paper of the ILAE Commission for Classification and Terminology

#### ILAE 2017 Classification of Seizure Types Basic Version<sup>1</sup>



#### Epilepsia

Volume 58, Issue 4, pages 522-530, 8 MAR 2017 DOI: 10.1111/epi.13670 http://onlinelibrary.wiley.com/doi/10.1111/epi.13670/full#epi13670-fig-0001





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#### **Operational classification of seizure types by the International League Against Epilepsy:** Position Paper of the ILAE Commission for Classification and Terminology

#### ILAE 2017 Classification of Seizure Types Expanded Version<sup>1</sup>







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#### Video: 5 year old; what type of seizure is this?





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#### Bipolar longitudinal montage: C3 sharp waves with a field to Cz and C4



#### More interictal discharges, C3 maximum



#### Seizure (Onset)



#### Seizure: Page 2



#### Seizure: Page 3



#### 5 year old boy, focal myoclonic seizures, T2 hyperintense L frontal lesion corresponded to proximal arm on TMS (Transcranial Magnetic Stimulation)









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#### ILAE 2017 Classification of Seizure Types Expanded Version<sup>1</sup>







### Follow-up

- Seizure free (24 months post-op)
- Tapered off OXC 12 months post-op
- No residual tumor on follow-up MRIs
- Pathology:
  - Angiocentric glioma





#### 3 year old boy w/R temporal lobe seizures; FCD – R T pole

video





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### Special Challenge – Neonatal

## (Video: focal clonic + electromechanical dissociation)







### From Epilepsy to the Epilepsies

- Epilepsy is a spectrum of disorders:
  - Many different types of seizures
  - Many etiologies
  - Many syndromes and types of epilepsy
  - Many co-morbidities
  - Associated with excessive mortality







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### Beyond Seizures: Comorbidities, "The Epilepsies"

- Somatic
  - Fractures, asthma, diabetes, heart disease
- Neurological
  - Autism, Alzheimer's, chronic pain, stroke
- Mental health
  - ADHD, anxiety disorders, mood disorders, suicidality





### Status Epilepticus (ILAE)

- < 5 mins: prodromal, premonitory, incipient
- 5 mins: impending status
- 5-30 mins: early or transitional
- 30 minutes: established status
- 60 mins or after 1<sup>st</sup>, 2<sup>nd</sup> line Rx's: refractory
- 24 hrs after anesthesia, or after 1-2 continuous infusions: super-refractory





### Why 30 minutes?

- Shift in mortality: 2.5% for 10-29 mins vs 20% for 30+ mins (all ages, non-febrile)
- Compensatory mechanisms fail
- Irreversible neuronal damage
- But misses a window of opportunity before neuronal injury and pharmacoresistance have occurred; thus, 5 mins is operational





### New Classification Systems for Status (proposed)

- Axes
  - 1. Semiology
  - -2. Etiology
  - 3. EEG correlates
  - -4. Age
  - Trinka et al, Epilepsia, Sept 2015





# Operational dimensions to status epilepticus (proposed)

Type of Status	T1 (likely to become prolonged)	T2 (may cause long term consequences)
Tonic-clonic	5 mins	30 mins
Focal w/impaired consciousness	10 mins	> 60 mins
Absence status	10-15 mins	Unknown





### Mortality in Epilepsy

- SUDEP: Sudden Unexpected Death in Epilepsy
- Associated with poorly controlled seizures, nighttime seizures, childhood onset, young adult age (20-40 yrs)
- Predisposition in monogenic epilepsies: SCN1A, SCN8A





### **Basic Facts about SUDEP**

- 2. SUDEP usually in aftermath of a GTCS
- 3.80% SUDEP is unwitnessed
- 4. Usually found deceased in bed, prone
- 5. Estimates 1:10,000 newly diagnosed;
   1:1000 chronic epilepsy; 2-10:1000 MRE
- Shankar et al: SUDEP: what every neurologist should know. Epileptic Disord 2017.
- Keller et al: Incidence of SUDEP in Children is Similar to Adults. Neurology 2018.





### New York Times July 10, 2019

#### How Cameron Boyce's Epilepsy May Have Caused His Death at 20

The Disney Channel star's family released a statement confirming his medical condition, which led to a fatal seizure over the weekend. In the U.S., about 2,600 people a year die from a disorder known as sudden unexpected death in epilepsy.







# Estimated Epilepsy Deaths in the United States for 2014\*



The Michael J. Bresnan Child Neurology Course

### **SUDEP Information Items**

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### **Risk Factors for SUDEP**

- 1. Frequency of GTCS
  - 1-2/yr: 5X ↑; 3+/yr: 15X ↑
- 2. Nocturnal seizures
- 3. Early age at epilepsy onset (< 16 yrs)
- 4. Male gender
- 5. Duration of epilepsy (> 15 yrs)
- 6. Lack of antiseizure drug treatment
- 7. Unwitnessed
- 8. Certain syndromes (Dravet, isodicentric chrom 15)





### **Modifiable Risk Factors**

- 1. Adherence to treatment
- 2. Avoid alcohol
- 3. Avoid sleep deprivation
- 4. Assistance overnight
- 5. Treat sleep apnea when appropriate
- 6. Monitoring devices role being established
- 7. Lattice pillow role being established







### The Child Who Never Grew

## Pearl S. Buck



Boston Children's Hospital Until every child is well

1950



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The Scope and Lexicon of Epilepsy

### Pearl S. Buck

- ...endurance of inescapable sorrow is something which has to be learned alone.
- Endurance is only the beginning. There
  has to be acceptance and the knowledge
  that sorrow fully accepted brings its own
  gifts.
- ...sorrow...can be transmuted into wisdom, which, if it does not bring joy, can yet bring happiness.





### Pearl S. Buck 1950

- ...my own resolve shaped into the determination to make meaning out of the meaningless...her life must count.
- I could not rejoice in the knowledge that others had the same burden that I had, but it made me realize that others had learned how to live with it, and so could I.









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The Scope and Lexicon of Epilepsy

# The Lexicon and Scope of Epilepsy



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