

SEIZURE MANAGEMENT IN PEDIATRICS

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No Disclosure



Objectives

By the end of this talk you would have an idea about:

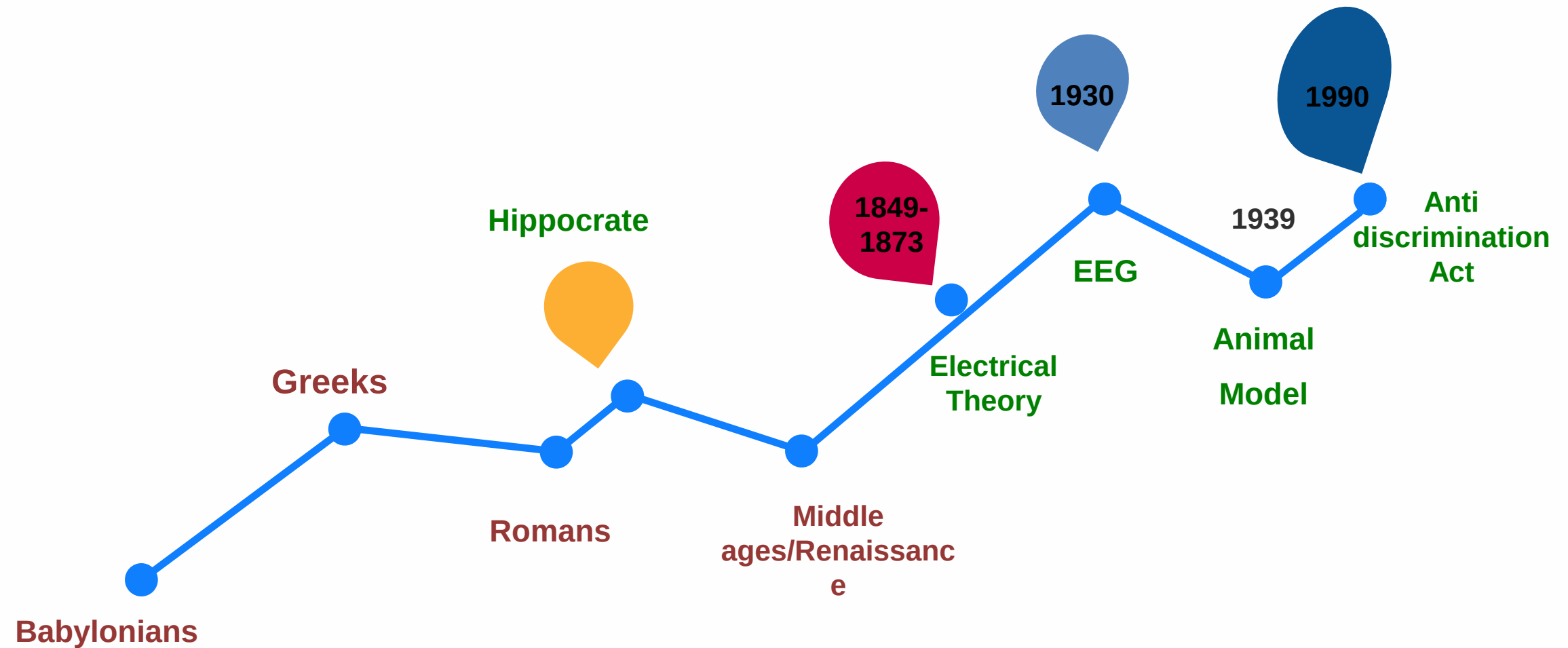
- Seizure/Epilepsy history
- Current epidemiological SE data
- Ability to define SE based on historical and modern evidence
- Pharmacological managements
- New advancement in the field

Epilepsy: Definition

- Ancient Greek word:
to seize, possess, or afflict



Epilepsy:History



Epidemiology:

- 17-23/100,000 per year (US)
From 0-1 year 135-150 incidents per 100,000 people
- Mortality 2-7%
- 54% previously healthy neurologically
- 75% SE might be the first seizure in life
- 10-25% with previous seizure disorder
- Risk of recurrent SE 13%



SE Definition:

Historical definition:

30 minute of seizures activity

or multiple seizure without return of normal mentation

Why 30 minutes?

Animal studies

showed that after 30 minutes neuronal injuries can be demonstrated even if respiration and circulations are maintained





SE “New” Definition

- Seizure for 5-10 minutes or more, Or
- 2 seizure or more with incomplete recovery of consciousness
- Patient with generalized seizure on arrival to ED should be treated promptly regardless of duration



Neurocritical care society 2012 Guideline:

- 5 minutes or more of continuous clinical or electrographic seizures activity OR
- Recurrent seizure activity without recovery in between
- *The 2016 American Epilepsy Society's Guideline for Status Epilepticus Management uses 5 minutes as it is time figure*

SE Categories

- Early SE “Impending”: 5 minutes
- Established SE: 5-30 minutes
- Refractory SE: persistent despite treatment with 2 or more proper dose anticonvulsants
- Super refractory SE: persistent seizure activity for days, weeks

Etiology of CSE



Acute Symptomatic

17-52%

Hypoxic injury
CNS infections
Metabolic
derangements
Drug issues
Toxic ingestions



Prolonged Febrile Convulsion

23-30%



Remote

16-39%

HIE
Neurodegenerative
disorders
Cerebral dysgenesis

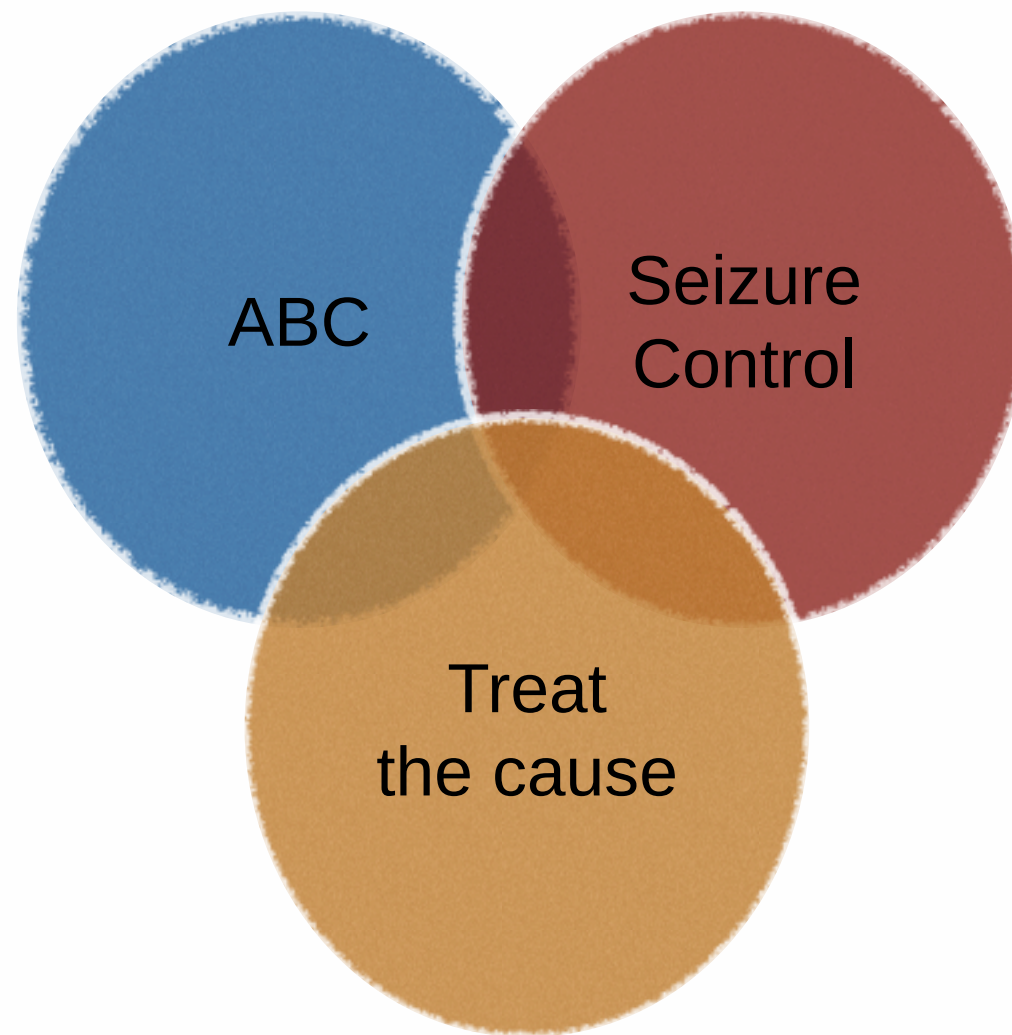


Idiopathic

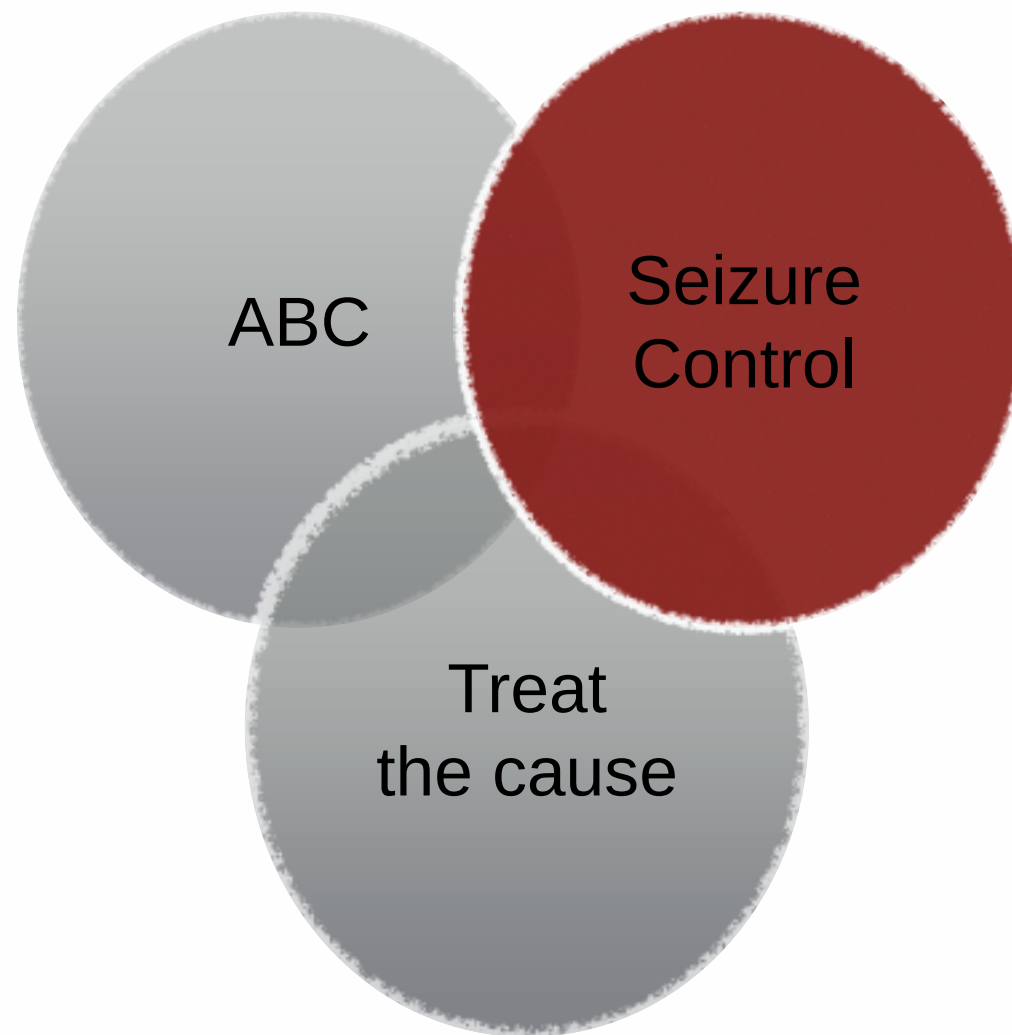
5-19%



SE Management



SE Management



Pharmacological Management



Pre-Hospital



First Line



Second Line



Third Line



First Line



Impending SE

“Emergent initial therapy”

IV dose:

A

Diazepam

ooooo

0.2-0.3 mg/kg

High lipid solubility

Onset

Rapid

Rapid loss of
anticonvulsant effect

Side effect

Hypotension and
respiratory depression

Midazolam

ooooo

0.2 mg/kg

2 minutes

Hypotension
Respiratory
depression

Lorazepam

ooooo

0.1 mg/kg

Low lipid solubility

2 mins

6-12 hours
anticonvulsant effect

Less hypotensive and
respiratory depression

A



First Line



Benzodiazepines with NO IV line



Diazepam

ooooo

Might be used

IM Dose

Other
routes

B

Rectal: 0.3-0.5 mg/kg
Max dose 10-20 mg
Onset: 5-10 minutes

Limitation

ROUTE !

Gel is expensive
5 mg gel = 78\$
5 mg IV solution 1.4\$
and can be used rectally

Midazolam

ooooo

A

0.2 mg/kg
Aqueous solution with
rapid absorption.

B

Onset 2 minutes
Buccal: 0.3-0.5 mg/kg
Max 10mg
Nasal: 0.2mg/kg Max
5mg/nosetripil

B

Knowledge
Devises/preparation
Expenses

Lorazepam

ooooo

Can be given but lacks
water solubility which
make it a delayed
onset

Buccal/PR: 0.1mg/kg
Max 4mg

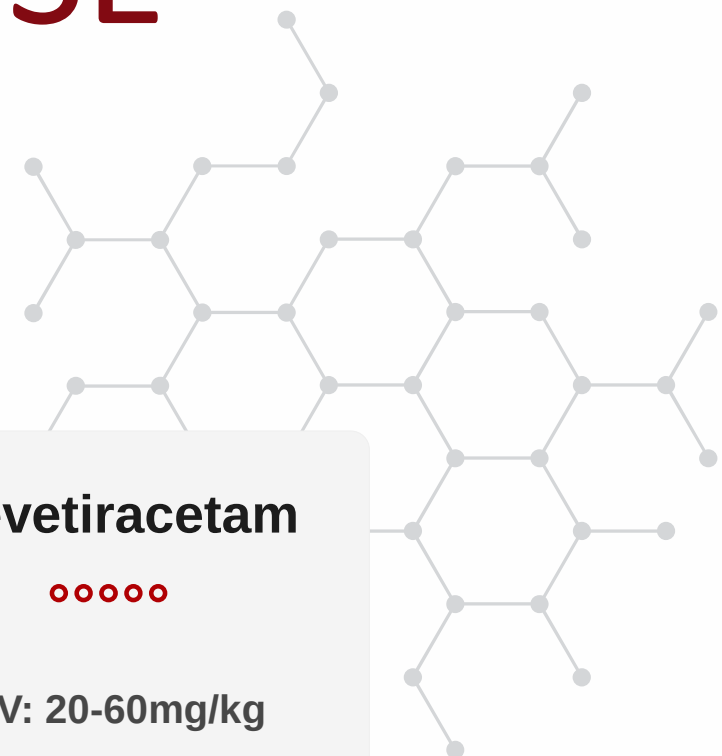
Knowledge
Availability
Expenses



Second Line



Established SE



Fosphenytoin

ooooo

IV: 20mg/kg over 10 mins
Max: 1.5 gm

IM not recommended
but can be used
I.O: scattered data
IM: expensive and not
always available



Arrhythmia
Bradycardia and
Hypotension

Phenytoin

ooooo

IV: 20 mg/kg over 20
mins
NO IM

I.O: scattered data



Purple glove syndrome
with extravasation
Arrhythmia
Bradycardia and
Hypotension

Valproic Acid

ooooo

IV: 20-40 mg/kg
Black box warning:
hepatotoxicity: <2 y, on
multiple antiepileptics or
has
mitochondrial/metabolic
disease



Hypotension,
Pancytopenia,
Thrombocytopenia,
Pancreatitis
Hyperammonemia

Levetiracetam

ooooo

IV: 20-60mg/kg

easy administration,
minimum drug
interactions



Aggression
Renal dose adjustment

Main route

Other
routes

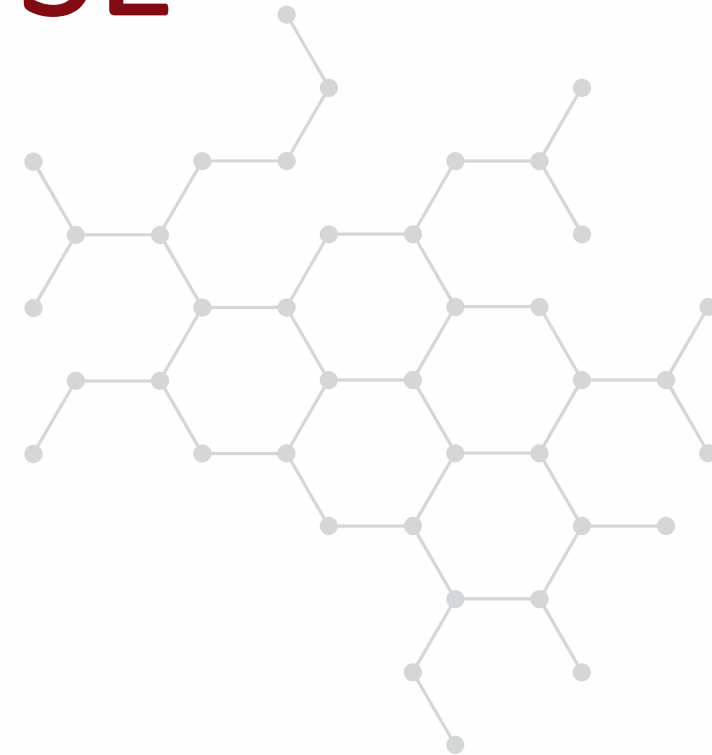
Side effects:



Second Line



Established SE



Phenobarbital

ooooo

Main route

IV: 15-20 mg/kg over
20mins

Max 1 gm

B

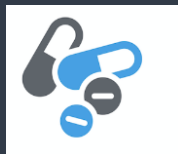
Side effects:

Half life 72 hours

sedation

hypotension

Respiratory depression



Third Line



Refractory SE



Phenytoin

Fosphenytoin

Valproic Acid

Levetiracetam

Phenobarbital

OR

Midazolam Infusion

ooooo

Bolus: 0.15mg/kg
then 2 mics/kg/min
Increase by 2
mics/kg/min Q5
min as needed

Anesthetic agents

ooooo

Propafol 1-2mg/kg

Thiopental 4
mg/kg then 2
mg/kg/hr

Pentobarbital

Evidence:

U

Summary



Pre-Hospital



First Line



Second Line



Third Line

Buccal
Intranasal
Rectal

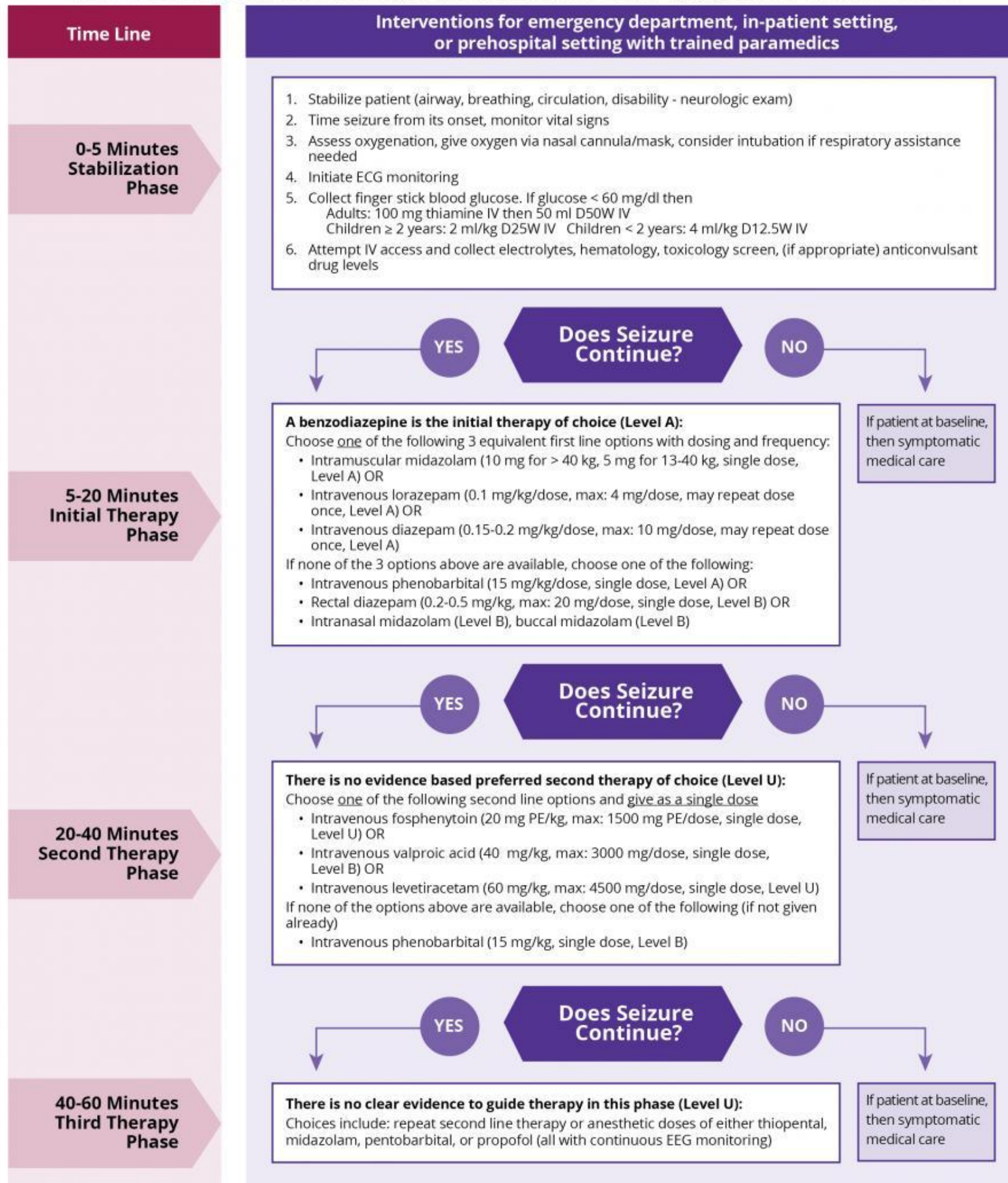
Benzodiazepine
IV
if no access
IM Midazolam
Rectal, buccal, nasal

Fos/Phenytoin
Valproic acid
Phenobarb
Keppra

Use second line meds
that you didn't use
OR
induces coma

Proposed Algorithm for Convulsive Status Epilepticus

From "Treatment of Convulsive Status Epilepticus in Children and Adults," *Epilepsy Currents* 16.1 - Jan/Feb 2016



American
Epilepsy
Society
2016

That's the present ..

**What about the
future?**



What's new

Ketamine

- NDMA receptor modulator
- Rising star in both adult and peds
- Refractory SE
- Suggested dose: 2-3 mg/kg then 10 mic/kg/min max 100 mic/kg/min
- 64% of Peds SE responded
- Avoids intubation compared to other agent in 3rd line management
- Rosati et al from Italy are currently doing a RCT comparing Ketamine to other Refractory SE agents **(KETASER01) trial**

What's new

Music

- Mechanism: not yet understood
- Hughes et al., first report music effect on epilepsy when they found reductions in epileptiform activities in comatose patients, with status epilepticus during exposure to Mozart K.448
- Lin et al., 70% of children with refractory epilepsy had a $\geq 50\%$ reduction in seizure frequencies after at least 6 months of Mozart K.448 listening once per night



Questions/Comments



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