

Project: Ghana Emergency Medicine Collaborative

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SEIZURES

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EMERGENCY MEDICINE R2

WHAT WE WILL COVER

- DEFINE WHAT A SEIZURE IS
- HOW TO STOP THEM
- SECONDARY SEIZURES
- SPECIAL CIRCUMSTANCES
- PSYCHOGENIC NON-EPILEPTIC SEIZURES (PNES)

WHAT WE WILL NOT COVER

- LONG-TERM AED THERAPY
- PATHOPHYSIOLOGY OF LOCALIZATION
- HOW TO CURE PSYCHOGENIC SEIZURES

Active Seizure

Midazolam
IM 10mg
Buccal 35mg
Diazepam
PR 0.5mg

No

IV/IO Access

RBS

FIRST LINE

May re-dose if no response

Lorazepam
4mg IV

Midazolam
5mg IV

Diazepam
10mg IV

SECOND LINE

Fosphenytoin
20mg/kg

Valproic Acid
20mg/kg

Phenobarbital
20mg/kg

Phenytoin
20mg/kg at
50mg/min

Propofol
1mg/kg over 5
minutes

LABS

FBS
Electrolytes
(plus mg, ca)
Renal Fnc
Urinalysis
Consider
CT Head
LP

CONSIDER

Intubation

- Failure to protect
- Failure to oxygenate

CASE # 1

- TUESDAY – 8:01AM - RED ZONE...
- 23Y M PRESENTS WITH FIRST ONSET SEIZURE
 - VITAL SIGNS HR 110, BP 150/80, RR 25, SAT 93%
 - STARTED 10 MINUTES PRIOR TO ARRIVAL

DEFINITIONS

- SEIZURE - ABNORMAL BRAIN FUNCTION FROM NEURAL DYSYNCHRONY
- STATUS EPILEPTICUS – NO CONSENSUS DEFINITION
 - UNINTERRUPTED SEIZURE LASTING LONGER THAN 5-10 MINUTES
 - MULTIPLE SEIZURES WITHOUT RETURN TO BASELINE
- REFRACTORY STATUS EPILEPTICUS (30-40% OF THOSE IN STATUS)
 - SEIZURES ONGOING AFTER FIRST AND SECOND LINE THERAPY

STATUS

- 20% MORTALITY
 - ANOXIA INCREASES TO 69-81%
 - FROM SECONDARY CAUSES (RHABDOMYOLYSIS, LACTIC ACIDOSIS, ASPIRATION, RESP FAILURE)
- NEURONAL DEATH OCCURS IN 30-60 MINUTES (CORTICAL LAMINAR NECROSIS)
- MORE LIKELY DUE TO
 - ENCEPHALITIS
 - MEDICATION NONCOMPLIANCE
 - WITHDRAWAL
 - STRUCTURAL INJURY

TYPES

NONCONVULSIVE

- SIMPLE PARTIAL – CONTINUOUS OR REPETITIVE FOCAL MOTOR OR SENSORY LESIONS
 - 'THE FLASHLIGHT IN THE CORNER OF EVERY ROOM'
- COMPLEX PARTIAL – SAME BUT WITH ALTERED CONSCIOUSNESS

CONVULSIVE

- GENERALIZED TONIC-CLONIC – CLASSICAL JERKING THEN FLACCID LIMBS WITH MYOCLONUS, ALWAYS WITH ALTERED CONSCIOUSNESS

THE OTHERS

- ABSENCE
 - ALTERATION IN CONSCIOUSNESS, MYOCLONUS, EYE BLINKING, APHASIA
- MYOCLONUS

SECONDARY SEIZURES

- VASCULAR
 - STROKE (ISCHEMIC/HEMORRHAGIC), TBI
- INFECTIOUS
 - ENCEPHALITIS, MENINGITIS, LOWERED THRESHOLD
- METABOLIC
 - HYPONATREMIA, HYPOGLYCEMIA, UREMIA, HYPOCALCEMIA, HYPOMAGNESEMIA, HYPERAMMONEMIA, LOW PYRIDOXINE, ACUTE INTERMITTENT PORPHYRIA, HYPOXIA
- TOXIC
 - INTOXICATION (COCAINE, STIMULANT, THEOPHYLLINE)
 - WITHDRAWAL (ETHANOL (7-48H FROM LAST DRINK), BENZODIAZEPINES, BACLOFEN)
 - LOWERED THRESHOLD
 - (QUINOLONE ANTIBIOTICS, TCAs, BUPROPION, CYCLOSPORINE, METRONIDAZOLE, ISONIAZID, BUPIVACAINE, PEN G, LITHIUM)

TESTING

- FBS
- ELECTROLYTES (PLUS MG, CA)
- RENAL PANEL
- URINALYSIS
- OTHERS
 - CT HEAD
 - LP
 - PROLACTIN
 - USEFUL ACUTELY IF QUESTION OF PSYCHOGENIC BUT CAN NORMALIZE
 - CREATININE KINASE
 - IF SUSPICION OF RHABDO/PROLONGED CONVULSION

ANTI-EPILEPTIC THERAPIES

- BENZODIAZEPINES
- PHENYTOIN
- PHENOBARBITAL
- PROPOFOL
- LEVETIRACETAM

BENZODIAZEPINES

ACT ON GABA RECEPTORS TO SLOW NEUROTRANSMISSION

- DIAZEPAM
- LORAZEPAM (ATIVAN)
- MIDAZOLAM (VERSED)

DIAZEPAM

- LIPID SOLUBLE, STABLE AT ROOM TEMP
- DOSE – 10MG IV/PR
- EFFECT IN 10-20 SECONDS IN 50-80% PATIENTS IN STATUS
- EFFECT CAN LAST <20 MINUTES
- HALF-LIFE – 30-60 HOURS

LORAZEPAM

- DOSE – 0.1MG/KG - 4MG IM/IV/IN SHOULD REPEAT X 1 IN 2 MINUTES IF NO EFFECT
- EFFECT ONSET – UP TO 2 MINUTES
- EFFECT DURATION – 4-6 HOURS
- HALF-LIFE – 14 HOURS

MIDAZOLAM (VERSED)

- DOSE – 0.1MG/KG - 5MG IV
 - 0.2MG/KG - 10MG IN/IM
 - 0.5MG/KG – 25MG BUCCAL
- EFFECT ONSET <1 MINUTE
- EFFECT DURATION – SHORTEST OF BENZOS
- COMMON DRIP (0.2MG/KG BOLUS, 0.75-10MCG/KG/MIN RATE)
- HALF-LIFE – 2.5 HOURS

PHENYTOIN

- DOSE - 20MG/KG LOADING DOSE AT RATE OF 50MG/MIN
- ADVERSE EVENTS
 - SEVERE HYPOTENSION (RATE RELATED)
 - ACUTE ARRHYTHMIAS (BRADY, TACHY)
 - VENOUS THROMBOSIS
 - STEVENS-JOHNSON SYNDROME
 - HEPATOTOXICITY

FOSPHENYTOIN

- PRODRUG OF PHENYTOIN, METABOLIZED IN PHENYTOIN IN SERUM
- DOSE – 20 MG (PHENYTOIN EQUIVALENTS[PE])/KG – RATE UP TO 150 PE/KG
 - INCREASED WATER SOLUBILITY
- ADVERSE EFFECTS
 - LESS CARDIOVASCULAR SIDE EFFECTS?
 - NO PROPYLENE GLYCOL

BARBITURATES

ACT ON CL- GABA RECEPTORS TO HYPERPOLARIZE AND INHIBIT NEUROTRANSMISSION

- PHENOBARBITAL
 - DOSE – 20 MG/KG AT RATE 30-50 MG/MIN
 - ADVERSE EVENTS – HYPOVENTILATION, HYPOTENSION
 - HALF-LIFE 87-100 HOURS
- PENTOBARBITAL
 - DOSE – 10 MG/KG AT RATE UP TO 100 MG/MIN
 - CONTINUOUS INFUSION AT 1-4MG/KG/HR
 - LIMITED BY HYPOTENSION, MAY REQUIRE PRESSORS AT HIGHER INFUSIONS
 - PRIMARILY FOR REFRACTORY STATUS
- THIOPENTAL
 - SHORTER HALF-LIFE BUT OVERALL ACCUMULATES DUE TO ACTIVE METABOLITES (PENTOBARBITAL)
 - IMMUNOSUPPRESSION?

PROPOFOL

PHENOLIC COMPOUND UNRELATED TO OTHER AEDs

- DOSE – 1MG/KG OVER 5 MINUTES, CAN BE USED AS DRIP UP TO 4MG/KG/HR
- SIGNIFICANTLY FASTER IN REFRACTORY STATUS THAN BARBITURATES
 - 3 MINUTES VS 123 MINUTES
- ADVERSE EFFECTS
 - HYPOTENSION, HYPOVENTILATION
 - PROPOFOL-INFUSION SYNDROME
 - METABOLIC ACIDOSIS, RHABDOMYOLYSIS, CARDIAC, RENAL DYSFUNCTION
 - DECREASED BY LIMITING TO < 2 DAYS

VALPROIC ACID

- GABA/NMDA ANTAGONIST?
- DOSE – 20MG/KG AT RATE UP TO 20MG/MIN
- SIDE EFFECTS
 - HYPOTENSION, DYSRHYTHMIAS
 - HYPERAMMONEMIC ENCEPHALOPATHY (CAREFUL IN SUSPECTED INBORN ERROR OF METABOLISM)

OTHER THERAPIES

NOT VALIDATED DUE TO LACK OF RANDOMIZED TRIALS (YET)

- TOPIRAMATE
 - BY NG TUBE
- LEVETIRACETAM (KEPPRA) (UNKNOWN MECHANISM)
 - 20-50MG/KG IV
 - POSITIVE INITIAL RESULTS IN PEDIATRIC STATUS
- LACOSAMIDE
 - 200-400MG IV
- KETAMINE
 - NMDA ANTAGONIST

PEDIATRIC CONSIDERATIONS

- PYRIDOXINE
 - 100MG IV UP TO AGE 2
- NON-ACCIDENTAL TRAUMA

AIRWAY
BREATHING
CIRCULATION

Active Seizure

Midazolam
IM 10mg
Buccal 35mg
Diazepam
PR 0.5mg

No

IV/IO Access

RBS

FIRST LINE

May re-dose if no response

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4mg IV

Midazolam
5mg IV

Diazepam
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SECOND LINE

Fosphenytoin
20mg/kg

Valproic Acid
20mg/kg

Phenobarbital
20mg/kg

Phenytoin
20mg/kg at
50mg/min

Propofol
1mg/kg over 5
minutes

LABS

FBS
Electrolytes
(plus mg, ca)
Renal Fnc
Urinalysis
Consider
CT Head
LP

CONSIDER


Intubation

- Failure to protect
- Failure to oxygenate

PSYCHOGENIC SEIZURES

1. Long duration of episodes
2. No occurrence from sleep
3. recall for the period when the patient appears unconscious
4. fluctuating course
5. rapid postictal recovery of responsiveness
6. ictal crying
7. asynchronous or asymmetrical movements; pelvic thrusting; opisthotonus, 'arc en cercle'; side-to-side head or body movement
8. closed eyes
9. tongue biting
10. urinary incontinence
11. motor features: flailing, thrashing movements
12. gradual onset
13. stereotyped attacks

POST-TRAUMATIC SEIZURES

- AED PREVENT EARLY SEIZURES
 - NNT 10 (COCHRANE 2001)
 - NO EFFECT ON MORTALITY
 - SHOULD ONLY BE STARTED IF SEIZURE PRESENT OR HIGH RISK FACTOR
 - FIRST LINE – PHENYTOIN 20MG/KG
 - KEPPRA 20MG/KG SHOWN AS EFFECTIVE WITH LESS ADR (SZAFLARSKI ET AL 2010)
 - RISK FACTORS FOR PTS
 - GCS<10
 - CORTICAL CONTUSION
 - DEPRESSED SKULL FRACTURE
 - SUBDURAL, EPIDURAL, ICH
 - PENETRATING WOUND
 - SEIZURE WITHIN 24 HOURS
- 

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