UC DAVIS HEALTH | CHILDREN'S HOSPITAL

Neonatal Seizures

Etiologies

Most seizures in neonates are acute provoked seizures; initial evaluations should focus on identifying underlying causes concurrent with treatment of seizures.

- HIE
- Stroke
- Intracranial hemorrhage
- Acute metabolic derangements (e.g., hypoglycemia, hypocalcemia, hyponatremia, hypomagnesemia)
- Infection (e.g., bacterial sepsis/meningitis, HSV)
- Drug withdrawal or intoxication
- Neonatal-onset epilepsy (~20%) – underlying etiologies include cortical malformations, inborn errors of metabolism (IEM), and other genetic conditions

Clinical Features

A large proportion of neonatal seizures do not have observable clinical manifestations. Newborns are less likely to display motor correlates due to the immaturity of motor tracts and relative lack of myelination at this stage in development. Newborns may also display non-epileptic paroxysmal movements, such as jitteriness or sleep myoclonus, which can be falsely categorized as seizures.

EEG is necessary to definitively diagnose neonatal seizures. While awaiting EEG, certain clinical features may help distinguish between seizures and non-epileptic movements.

Probable seizures:
- Stereotyped, rhythmic clonic movements that cannot be suppressed by restraint or repositioning.

Unlikely to be seizures:
- Jitteriness or tremors that are stimulus-sensitive or resolve with repositioning.
- Movements that are non-stereotyped or random.

Other types of paroxysmal events, such as tonic posturing, eye movements, or automatisms cannot reliably be diagnosed as seizure or non-seizure without EEG.

Diagnostic Workup

The diagnostic workup for neonatal seizures should start by assessing for acute provoking causes, starting with reversible causes.

- Check serum electrolytes (including Ca and Mg) and serum glucose, and *correct any abnormalities*
- Head ultrasound as soon as possible while awaiting MRI
- Brain MRI (discuss with neurology team whether MRS, MRA, and/or MRV is indicated)
- Sepsis workup including LP, if concern for infection
- Placental pathology (ask OB team to send placenta for pathology)
- Consider toxicology screening (urine tox, meconium tox)
- If concern for IEM*, consider sending blood gas with lactate, labs (serum amino acids, urine organic acids, serum ammonia, serum lactate/pyruvate, acylcarnitine profile, very-long-chain fatty acids) and consulting Genomic Medicine
- If MRI does not reveal a cause of seizures, consider consulting Genomic Medicine to evaluate for genetic causes of seizures (incl. *KCNQ2* variants)

**Consider IEM in the following settings:*

- *Encephalopathy with poor feeding and lethargy following an initial symptom-free period of a few to several days*
- *Seizures refractory to conventional treatment*
- *Seizures associated with progressive deterioration of clinical status and worsening of EEG background pattern*
- *Myoclonic seizure semiology*

Management

Neuroprotective measures

Care should be taken to maintain normothermia (unless undergoing therapeutic hypothermia for presumed HIE), normal ventilation (with strict avoidance of hypocarbia) and oxygenation, normal blood pressure, normoglycemia, and normal serum electrolyte levels.

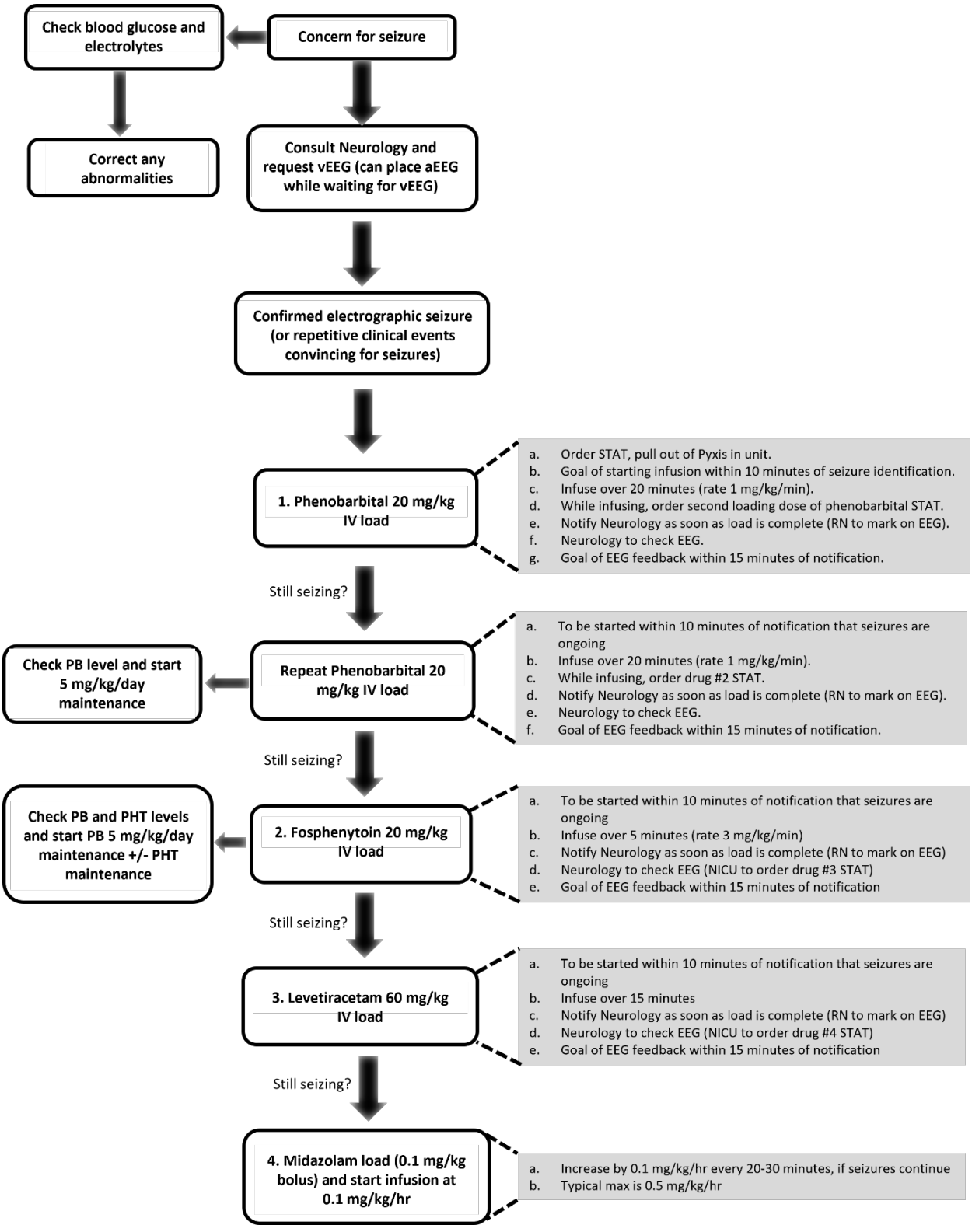
Neurology Consultation

Please consult neurology for all neonates with seizures. The NICU team and neurology can discuss together individual patient factors that might warrant alternatives to the pathway below, as well as consideration of additional or adjunctive treatments (such as pyridoxine) for refractory seizures.

Pharmacotherapy

See Management Algorithm on next page for recommended medications and dosages. Medical management of neonatal seizures should always be done in collaboration with the Child Neurology team.

Management Algorithm



NICU EEG Order & Communication Workflow:

- Requests for cEEG hookups should be ordered in Epic AND communicated by phone/Tiger Text to the on-call pediatric neurology resident.
    - Both are needed for the cEEG to be initiated
    - On-call pediatric neurology resident will communicate with EEG Tech to ensure request is received and triaged as priority.
- EEG Tech will initiate cEEG as early as possible
    - If delay is anticipated due to queue of cEEG hookups pending, NICU may choose to use aEEG in interim
    - Once cEEG initiated, EEG Tech will notify on-call Peds EEG reader
- Initial EEG interpretation will be completed within 1 hour of cEEG initiation
    - Peds EEG reader will communicate result to on-call pediatric neurology resident
    - Pediatric neurology resident will contact NICU to share EEG results and discuss next steps in patient care as priority.
    - To contact the appropriate NICU provider, Ped Neuro Provider will:
        - Call NICU front desk at x33050 and ask to speak to the NICU Fellow (NICU HUSC will Vocera “Neonatal Fellow” to pick up extension)
        - If NICU fellow is unavailable, call NICU Front desk x33050 and request to speak to the NICU Attending (NICU HUSC will Vocera “Neonatal Attending” to pick up extension)
- Subsequent EEG checks will be at frequency determined by clinical need
    - All cEEGs are screened by EEG technologists day & night
    - If no seizures and reassuring EEG, reviewed by Peds EEG reader at minimum twice each day with results communicated to on-call pediatric neurology resident, and a written report daily.
    - If seizures identified on EEG, EEG checks will be as each step of the treatment pathway is completed (e.g., after first drug is given, after 2nd drug is given, etc.)
        - Bedside providers to designate when drugs are given by pushing the button and saying out loud which drug is starting at that time
        - Updates on EEG findings will be relayed by the on-call pediatric neurology resident as a priority, to discuss with the NICU in combination with treatment recommendations
- Requests for additional EEG checks
    - In addition to EEG checks as above, clinical changes or suspicious events may prompt request for additional EEG checks.
    - Each suspicious clinical event should be marked at the bedside by pushing the button and stating out loud the nature of the event in question.
    - For most events, pushing the button will flag the event for the attention of the screening tech (most immediately) and for the Peds EEG reader (during their periodic reviews of the record).

- To request urgent review of EEG for sustained/frequent events concerning for seizure, the NICU should contact the on-call pediatric neurology resident.

Note: Overnight, additional EEG checks by the Peds EEG reader may need to be clustered and/or capped; EEG tech review will remain ongoing.

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