CICU Neonatal and Infant Seizure Pathway

Seizures Identified

Initial studies:
- Labs: CBC/diff, CMP, ammonia, ABG, ionized Ca, finger stick glucose, AED levels if applicable
- Consider LP if concern for infection and HCT without signs of increased ICP
- Imaging: HCT (consider contrast if concern for acute infection) or MRI (consider gad if concern for infection)
- Continuous EEG

Metabolic derrangements that can cause seizures:

- Blood glucose > 40 mg/dL
- Serum sodium < 125 mEq/L
- Serum iCa < 1.0
- Serum magnesium <1.8

PEARLS:
- Subtle clonic movements or persistent encephalopathy is suggestive of ongoing seizures
- Caution when loading with fosphenytoin or phenobarbital when it is a baseline AED
- Guide nursing to obtain fosphenytoin and phenobarbital from pyxis, do not wait for pharmacy.
- Measure TOTAL phenytoin levels (not free) and albumin

AED Monitoring on ECMO
- Anticipate need for repeat load and higher maintenance dosing due to multiple med interactions and increased blood volume.
- CRRT/dialysis may impact AED levels.
- Obtain levels 2 hours post initiation of ECMO or dialysis.

1st line seizure management:
- Midazolam or lorazepam bolus x 2
  - Lorazepam 0.1 mg/kg (max 4 mg) IV/IM
  - **OR**
  - Midazolam 0.1 mg/kg (max 10 mg) IV/IM
- If ongoing seizure or persistent encephalopathy:
  - Phenobarbital 20 mg/kg (max 1000 mg)
  - Can split load into two 10 mg/kg loads if concerned for hypotension
    - *If no further doses given, send phenobarbital level 1 hour after load*
  - Consider additional 10mg/kg bolus phenobarbital if ongoing seizure after first load
    - *Obtain phenobarbital peak 1 hour after load*
  - If level allows, consider giving additional 10mg/kg bolus if ongoing seizure (up to 40mg/kg load TOTAL)
  - *If patient hypotensive consider giving fosphenytoin*
- If ongoing seizure or persistent encephalopathy:
  - Fosphenytoin 20 mg/kg (max 1500 mg/dose) - *caution for patients with arrhythmias*
  - Obtain TOTAL phenytoin peak level with albumin level 1 hour after load

Seizure cessation or reduction in abnormal EEG pattern achieved?

Yes

- CT scan or MRI for new onset seizure
- Consider LP for fever
  - Start empiric antibiotics and acyclovir
- Continuous EEG for 24 hours seizure free or mental status back to baseline.
- Continue maintenance of phenobarbital 5 mg/kg /day divided BID. If seizures return start Fosphenytoin maintenance 5 mg/kg/ day divided TID

No

Proceed to Refractory Status Epilepticus Pathway (page 2)

Status Epilepticus Pathway: CICU (infants <6 mos)

SUPPORTIVE CARE

- Aggressively manage sources of secondary insult
  - Fever, Hypotension, Hypoxemia
- Head of bed at 30° and midline
- Avoid hyponatremia, hypocalcemia, hypomagnesemia.
- Hourly neuro checks

Respiratory
- Prophylactic intubation not indicated at lower versed infusion rates (≤0.4 mg/kg/hr)
- Monitor closely for impaired airway protection/ability to clear secretions
- Maintain $PaCO_2$ 35-40 mmHg

Cardiovascular
- Versed results in lowered SVR and depressed cardiac output
- Maintain MAPs at 50%^{ile} for age

FEN/GI
- Accu check glucose q 4-6 hrs while on IVF
- Consider GI prophylaxis

ID
- Refer to Acute Encephalopathy Algorithm if suspected infectious/ inflammatory etiology

Heme
- DVT prophylaxis w/ venodynes if past puberty

Musculoskeletal/Skin
- Specialty care bed and close monitoring for decubitus ulcers
- Physical therapy consult for splints and range of motion exercises

- Initiate midazolam infusion**. Goal: seizure cessation**
- Bolus 0.1 mg/kg, start infusion at 0.1 mg/kg/hour
- Increase infusion by 0.2mg/kg/hr every 15 minutes until cessation of seizures (clinical and electrographic)
- Bolus with every increase in infusion dose (dose same as current rate of infusion up to maximum of 0.5mg/kg)
- **Max infusion dose 2mg/kg/hour , max bolus 0.5 mg/kg**

At the same time of starting midazolam infusion:
- If NG tube: Start Topamax 10mg/kg divided BID maintenance
- If NO NG tube: Keppra 40mg/kg load x 1 and start keppra maintenance 60mgkg/day
- If little or no effect of midazolam by 0.3mg/kg/hr, consider ketamine bolus and infusion (**proceed to page 3)**

Seizure cessation

Yes

No

Maintain versed infusion x 48 hours
If seizure occurs, titrate to maintain cessation of seizures
- Bolus at hourly infusion rate (max 0.5 mg/kg) and increase infusion by 0.2mg/kg/hr (max 2mg/kg/hr)

- Initiate Ketamine. **Goal: seizure cessation (see page 3)**

Once seizure cessation at least 24 hrs (prefer 48 hrs) begin weaning versed infusion by no faster than 0.1mg/kg/hr q 6hrs

Return of seizures?

No

Yes

- Bolus versed equivalent to one hours worth of last effective dose and resume versed infusion at last effective dose
- Check levels of background AEDs
- Continue versed infusion for minimum of 24-48 hrs of goal seizure control
- Then resume wean at slower rate than previously attempted

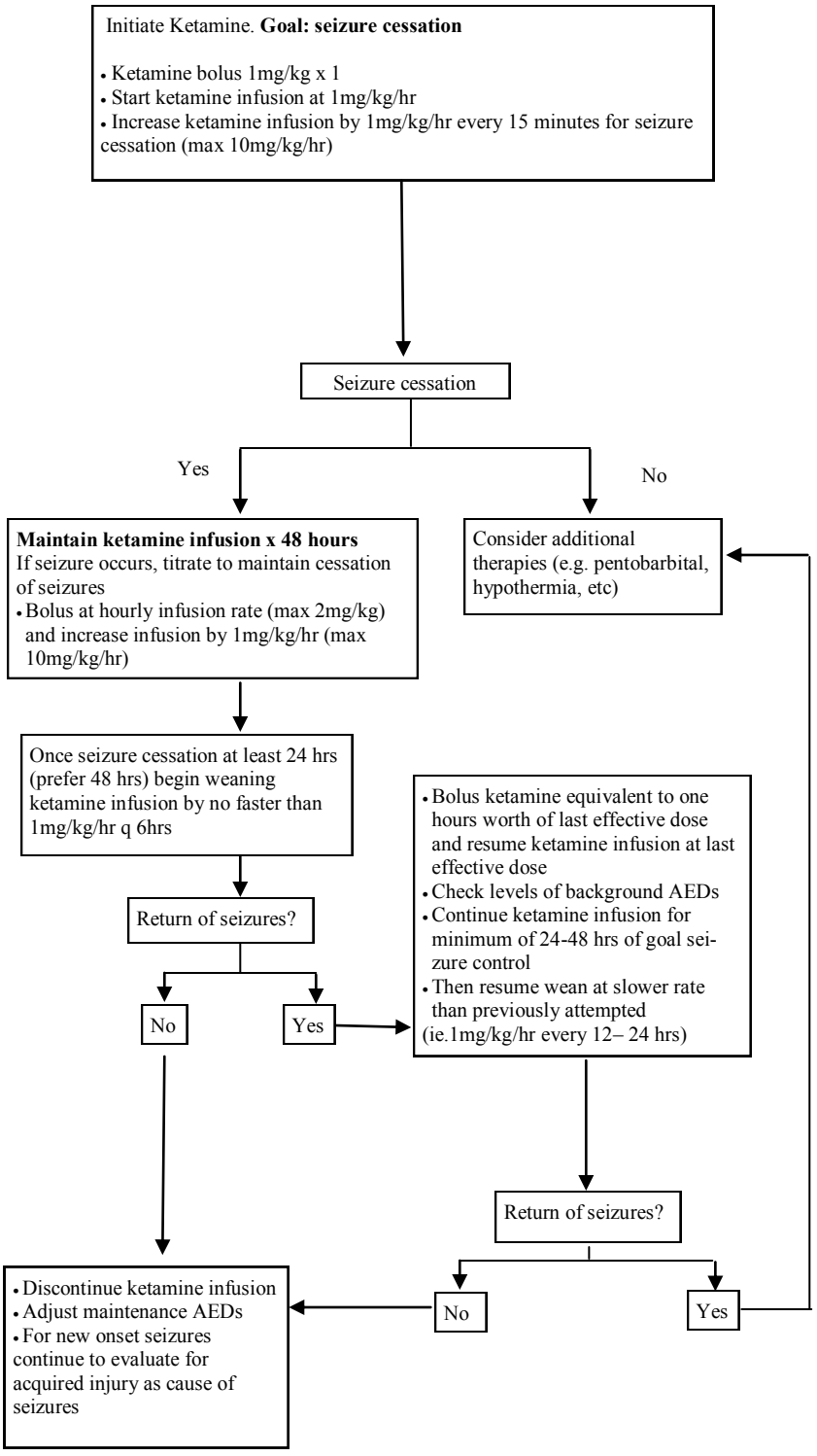
(ie– 0.1mg/kg/hr every 12– 24 hrs)

Return of seizures?

No

Yes

- Discontinue versed infusion
- Adjust maintenance AEDs
- For new onset seizures continue to evaluate for acquired injury as cause of seizures


Initiate Ketamine. **Goal: seizure cessation**
• Ketamine bolus 1mg/kg x 1
• Start ketamine infusion at 1mg/kg/hr
• Increase ketamine infusion by 1mg/kg/hr every 15 minutes for seizure cessation (max 10mg/kg/hr)
Seizure cessation
Yes
No
Maintain ketamine infusion x 48 hours
If seizure occurs, titrate to maintain cessation of seizures
• Bolus at hourly infusion rate (max 2mg/kg) and increase infusion by 1mg/kg/hr (max 10mg/kg/hr)
Consider additional therapies (e.g. pentobarbital, hypothermia, etc)
Once seizure cessation at least 24 hrs (prefer 48 hrs) begin weaning ketamine infusion by no faster than 1mg/kg/hr q 6hrs
Return of seizures?
No
Yes
• Bolus ketamine equivalent to one hours worth of last effective dose and resume ketamine infusion at last effective dose
• Check levels of background AEDs
• Continue ketamine infusion for minimum of 24-48 hrs of goal seizure control
• Then resume wean at slower rate than previously attempted
(ie.1mg/kg/hr every 12– 24 hrs)
Return of seizures?
No
Yes
• Discontinue ketamine infusion
• Adjust maintenance AEDs
• For new onset seizures continue to evaluate for acquired injury as cause of seizures