Journal Reading

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Introduction

- A comatose survivors of cardiac arrest,
- Early myoclonus +/- MSE(myoclonic status epilepticus)
  ◦ considered a sign of severe global brain ischemia
  ◦ ↑ mortality and poor neurologic outcomes.

- Therapeutic hypothermia(TH) advent
  ◦ Myoclonus = poor prognosis ??
- Recent study
  ◦ Variable !
- We report
  ◦ three survivors of cardiac arrest s/p ROSC s/p TH with early moyclonus → good neurologic outcomes

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CPC scores

- 1 = conscious, alert, able to work, might have mild neurologic or psychologic deficit;
- 2 = conscious and alert with moderate disability;
- 3 = conscious with severe disability;
- 4 = comatose or in a persistent vegetative state;
- 5 = brain death

Glasgow-Pittsburgh Cerebral Performance Category

Diagnostic criteria for myoclonic status epilepticus.

1. Comatose patient
2. Continuous (usually massive) myoclonus, with rhythmic or irregular bilateral synchronous jerking of face, trunk, and limbs, often with repetitive blinking, eye opening, upward eye rolling, and mouth twitching
3. Onset within the first 24 hours following the hypoxic-ischemic injury
4. EEG showing generalized, bisynchronous polyspikes, spikes or sharp waves preceding and time-locked with the clinical myoclonus, superimposed on a diffusely slow and suppressed background or burst-suppression pattern.*

There are two main caveats to the EEG criteria:

1. Sometimes fragmentary myoclonus can be seen without an EEG correlate; these are usually thought to be of brainstem origin and also portend a poor prognosis.
2. Often the EEG correlate is obscured by muscle jerking, in which case a short-acting paralytic can be used to suppress the movements so the EEG can be read.

Table 1

Clinical characteristics of three patients with post-cardiac arrest myoclonus and neurologic recovery after therapeutic hypothermia.

Clinical characteristics	Patient 1	Patient 2	Patient 3
Age (years)	79	56	66
Gender	Female	Female	Male
Past medical history	HTN	HTN	None
Location of arrest	In-hospital, witnessed	Private home, witnessed	Private home, unwitnessed
Bystander CPR?	In-hospital ACLS	Yes	Yes
Initial arrest rhythm	VT	Asystole, VF	VF
Number of defibrillator shocks	2	2	2
ACLS medications	Amiodarone, Dopamine, Norepinephrine	Amiodarone, Atropine, Dopamine, Epinephrine	Lidocaine
Estimated total downtime	5 min	10 min	13 min
Etiology of arrest	Anterior STEMI	Anterior STEMI	ACS
Time from ROSC to myoclonus onset	2.5 h	4 h	4 h
Troponin T (ng/mL)[a]	24.2	1.64	0.02
Lactate (mmol/L)[a]	7.1	5.5	Not performed
Time from ROSC to TH initiation	[b]	4 h	4 h
Length of TH	12 h[c]	24 h	24 h
Maximum CPC score after TH	2	1	1
Non-Contrast CT head results[d]	No ICH, mass, infarct, or edema	No ICH, mass, infarct, or edema	No ICH, mass, infarct, or edema
MRI head results[e]	Not performed	No acute infarct or intracranial pathology	No acute infarct (+) moderate hydrocephalus
cEEG findings	Diffusely slow background rhythm	Burst suppression/epileptiform features, possible MSE	Slow, disorganized background rhythm
Time from ROSC to cEEG initiation	25 h	8 h	16 h
Hospital LOS	29 days	5 days	10 days
Discharge CPC score	5	1	1
Discharge condition	Died	Ambulatory w/walker, short term memory deficit, independent ADLs	Ambulatory, good cognitive function, independent ADLs
Discharge disposition	N/A	Acute rehab facility	Home with PT
30 day follow-up condition	N/A	Returning to her job as a second grade teacher[f]	No documented clinic/hospital visit[f]

Discussion

- Neurology. 1988, Krumholz et al.
  - a prospective analysis
  - *died before discharge* :
    - Status myoclonus: 7/7, 100%
    - MSE : 19/23, 84%
- Ann Neurol. 1994, Levy et al. ,
  - 90% pt with post-arrest myoclonus either died or had *poor functional outcomes*
- Neurology. 2006, Zandbergen er al.

- The implementation of induced hypotherima in cardiac arrest patient s/p ROSC
  - The associated poor prognoses factors need to be re-evaluated
- Tow recent studies
  - 5/5(100%) pt with early "status myoclonus" died.
  - 35/36(97%) pt with early myoclonus had CPC scores 3-5

- All three of the patients in this report had *early onset of myoclonus* and thus did not have Lance-Adams Syndrome.

- The three patients (two with massive myoclonus and one with possible MSE) described in this case series all experienced good neurological outcomes following post-arrest treatment with TH.
  - ???

- Neuroprotective (i.e. TH)
- Delaying withdrawal of care decisions
- More comprehensive approach to post-arrest care
- Other factors

Conclusion

- The concept that myoclonus heralds a poor prognosis may need to be reconsidered in the era of post-cardiac arrest therapeutic hypothermia.
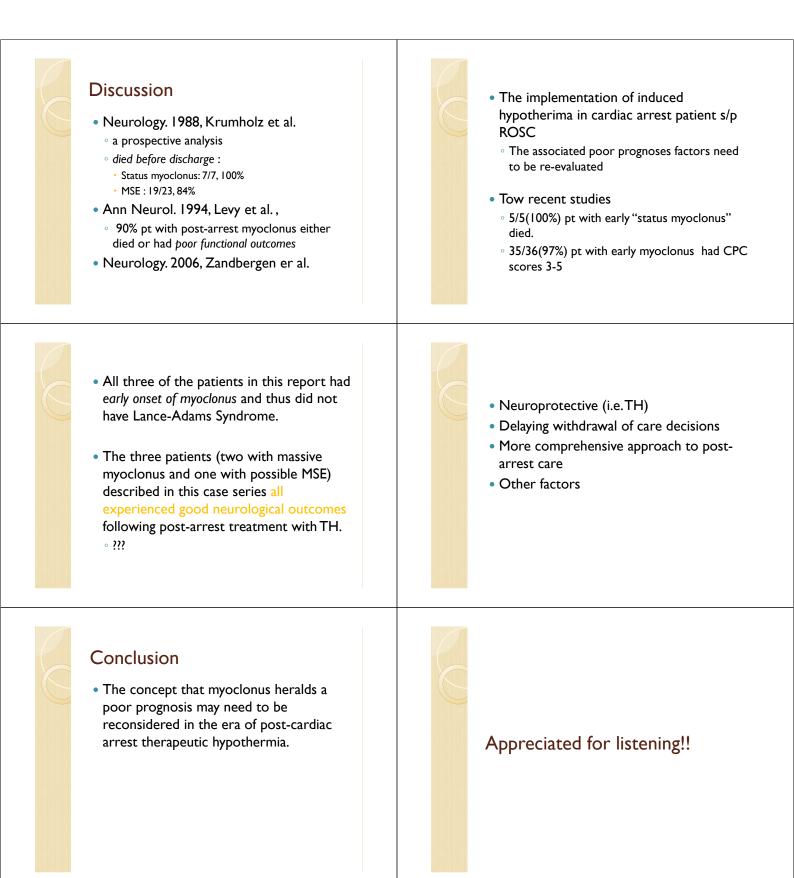

Appreciated for listening!!

TABLE 1. Features Suggesting a Poor, Indeterminate, or Good Prognosis in Patients Treated With Therapeutic Hypothermia

Features that likely suggest a poor prognosis
    Absence of a pupillary light response at 72 h[6,16]
    Absence of corneal reflexes at 72 h[17]
Features that may suggest a poor prognosis
    Bilateral absence of the cortical N20 response[6,17,28,29]
    Suppression-burst EEG pattern during hypothermia[34,35]
    Rising NSE level between 24 and 48 h post-arrest[57,60]
    Significant depressions of MRI ADC values at 72 h[79]
Features that are considered indeterminate
    Absence of motor function at 72 h[16]
    Flat EEG pattern during hypothermia[34,35]
    Presence of myoclonic status epilepticus at any time[47]
    NSE level greater than 33 µg/L at 72 h[6,58]
Features that may suggest a good prognosis
    Presence of a motor response of withdrawal or better within 48 h post-arrest[18]
    Continuous EEG pattern without epileptiform activity during hypothermia[34,35]
    Absent or minimal abnormalities in ADC values at 72 h[70,77]

Features are the opinion of the authors, based on available data (cited). No features appear to be able to absolutely predict a poor prognosis, and no features have been proven to predict a good prognosis.

ADC indicates apparent diffusion coefficient; EEG, electroencephalography; MRI, magnetic resonance imaging; NSE, neuron-specific enolase.

- absent N20 responses of median nerve somatosensory evoked potentials in patients receiving induced hypothermia