Coma Evaluation After Therapeutic Hypothermia for Cardiac Arrest:

Background: Therapeutic hypothermia (TH) is recognized as standard of care for treatment of post-cardiac arrest coma due to out of hospital ventricular fibrillation with prompt return of circulation. Good evidence indicates that TH alters the natural history of post-arrest hypoxic-ischemic encephalopathy with significantly better outcomes. Recent studies also indicate, however, that TH adversely impacts the validity of the clinical features used to assess prognosis in comatose patients after arrest-resuscitation. Evaluation of comatose patients after arrest-resuscitation has focused on detecting individuals with dismal prognoses. As codified in a 2008 Practice Parameter issued by the American Academy of Neurology, clinical evaluation at 72 hours post-arrest/resuscitation provides excellent, essentially perfect, specificity for detecting patients with poor outcomes. Several recent studies indicate that the value of clinical signs, particularly assessment of best motor response, is degraded after TH with the potential for false positive assignments of dismal prognoses.

The Role of Laboratory and Clinical Electrophysiological Studies: Methods have been suggested to supplement clinical prediction of prognosis in post-arrest/resuscitation. Serum levels of neuron specific enolase (NSE) are one suggested predictor. Recent work indicates that TH also reduces the value of serum NSE measurements as a prognostic measure. Absence of well defined cortical somatosensory evoked potentials (SSEPs) is another suggested predictor of poor prognosis but there are reports of false positive absent SSEP results after TH treatment. Some clinical electrophysiologic prognostic tests are dependent upon evaluation without the presence of sedation, which is especially problematic in patients who have recently undergone hypothermia because it disrupts the half-life of sedating medications.

A Multimodal Approach: Recent prospective observational studies identify several clinical features and modalities that are predictive of poor outcome in comatose cardiac arrest patients, both with and without TH (Rossetti et al. (Annals Neurol. 2010); Fugate et al (Annals Neurol. 2010)). These studies describe several clinical, laboratory, and electrophysiological tests that can be used to predict prognosis. While there were several limitations to these studies, such as the problem of self-fulfilling prophecies of poor outcome, they provide reasonable data to support determination of the prognosis using a combination of tests. Several findings on examination and with other modalities were strongly prognostic of poor outcome: absent brainstem reflexes, early myoclonus, malignant EEG, bilaterally absent cortical SSEPs, and global cerebral edema on head CT. Several other modalities were helpful but sometimes falsely predicted poor outcome (such as elevated NSE, gaze deviation, absent motor response). Given that this is an ongoing research area, it is important to approach this question using a combination of several measurements and rely upon the clinical opinion of the Neurology consult team to determine prognosis.

Proposed Guidelines:

1) Any patient in whom prognosis assessment after cardiac arrest is desired requires a Neurology consult. Assessment of prognosis after cardiac arrest is a different question than Brain Death determination and these two should not be confused.

2) Neurological evaluation by the Neurology Consult team at approximately 72 hours post arrest and off all sedation for at least 12 hours. Clinical examination findings should be complemented with one or more of the other evaluation modalities listed below. Clinical diagnosis of early myoclonus should be established by the Neurology Consult Service. The Neurology Consult Service should be contacted earlier than 72 hours post arrest if myoclonus or seizures are suspected.
3) Extreme caution should be maintained when evaluating prognosis in patients who are or recently were receiving any sedatives, including opiates and antiepileptic medications. Testing done with ongoing or recent sedation may be confounded and produce misleading results.

4) Complementary Modalities
   a. EEG to evaluate for malignant patterns (EEG services available on all days of the week). Patient should be normothermic and off sedation > 12 hours. Should be performed on day 3 post-arrest, roughly coincident with clinical evaluation. Diagnostic EEG to evaluate possible seizures or myoclonus can be performed at any time.
   b. SSEPs to evaluate for absent N20’s (may be performed on days 2-5 post arrest, not affected by sedation, available weekdays).
   c. Head CT after 72 hours.

5) Assessment of prognosis by the Neurology Consult team using multimodal approach as described above.

6) Guidelines should be reviewed annually as additional data is accumulated in the peer-reviewed literature.