

Predicting Neurologic Outcome after Cardiac Resuscitation

Significance:

- Resuscitation from cardiac arrest is often frustrated by failure of neurologic recovery.
- More than half of cardiac arrest survivors die in persistent coma or in a vegetative state, and the remainder often exhibit differing degrees of brain injury.
- Algorithms and indicators that predict poor prognosis are important tools in clinical decision making and discussions with colleagues and family.

Prognostic Tools for Mortality:

- The Glasgow Coma Scale (GCS) is the most universally used measure in the pre-hospital setting. --A GCS of < 5 is considered the best cutoff for predicting mortality.
- The APACHE II score is the most common in-hospital predictor of mortality. --An APACHE II score of < 19 is considered the best cutoff for predicting mortality
- In a 2001 study by Grmec et al¹, APACHE scores < 19, GCS < 5, and MEES score < 18 were compared and exhibited similar predictive capacities (80%, 82% and 78% respectively) for mortality.

Prognostic Tools for Morbidity:

- CPC scores (Cerebral Performance Category) are used by many studies to describe “good” and “poor” outcomes:

1. CPC of 1-2 is “good”
2. CPC of 3-5 is “poor”

CPC Score	Definition
1	Conscious and alert with normal function or only slight disability
2	Conscious and alert with moderate disability
3	Conscious with severe disability
4	Comatose or persistent vegetative state
5	Brain dead or death from other causes

- Levy et al² describe a series of 210 patients who suffered hypoxic-ischemic coma, 13% of whom regained independent function (CPC1-2) in the first year. A regression analysis generated rules to classify patients by likely outcome:

Initial exam/first 24 hours:

- Absent pupillary reflexes at initial exam= no expected recovery of independent function
- Predictors of potential return to independence (41% of patients developed CPC of 1 or 2)
 1. Initial presence of pupillary reflexes
 2. Development of roving eye movements that were conjugate or better
 3. Extensor, flexor, or withdrawal responses to pain

At 24 hours:

1. “Poor” outcome patients exhibited either no movement or posturing and eye movements that were neither orienting nor conjugate. Only 1 of these patients regained independent function.
2. 63% of patients who opened eyes, obeyed commands, or who had withdrawal or localizing response to pain showed significant recovery.

At 72 hours:

- A meta-analysis³ from 1966-1998 of studies describing neurologic outcomes and outcome predictors after CPR found the following predictors of outcome at 3 days post arrest:

Test	Pooled Cases	Observed Predictive Value	95% CI
No motor reponse or extensor posturing to pain	150	100%	98-100%
GCS < 5	73	100%	96-100%
No eye opening to pain	50	98%	96-100%
No pupillary light responses	29	100%	90-100%
Absent cranial nerve reflexes	55	96%	93-99%

Altering the outcome:

- In patients who have been successfully resuscitated after cardiac arrest from VT or VF, hypothermia protocols such as the one described 2/02 in NEJM can improve both neurologic outcomes and mortality by approximately 15%.

References:

1. Gremec, Stefek and Gasparovic, Vladimir. Comparison of APACHEII, MEES, and Glasgow Coma Scale in patients with nontraumatic coma for prediction of mortality. Critical Care 2001, 5:19-23
2. Levy, D.E., Caronna, J.J., Singer, B.H., et al. Predicting outcome from hypoxic-ischemic coma. JAMA Vol 253 no. 10, March 8.1985.
3. Tweed, William. Predicting Poor Neurologic Outcome after Cardiac Resuscitation. Special communication, Dept of Anaesthesiology, King Faisal Specialist Hospital, Riyadh, Saudi Arabia.
4. The Hypothermia after Cardiac Arrest Study Group. Mild Therapeutic Hypothermia to Improve the Neurologic Outcome after Cardiac Arrest. NEJM, Feb. 21.2002. Vol 346 no 8 pages 549-556.